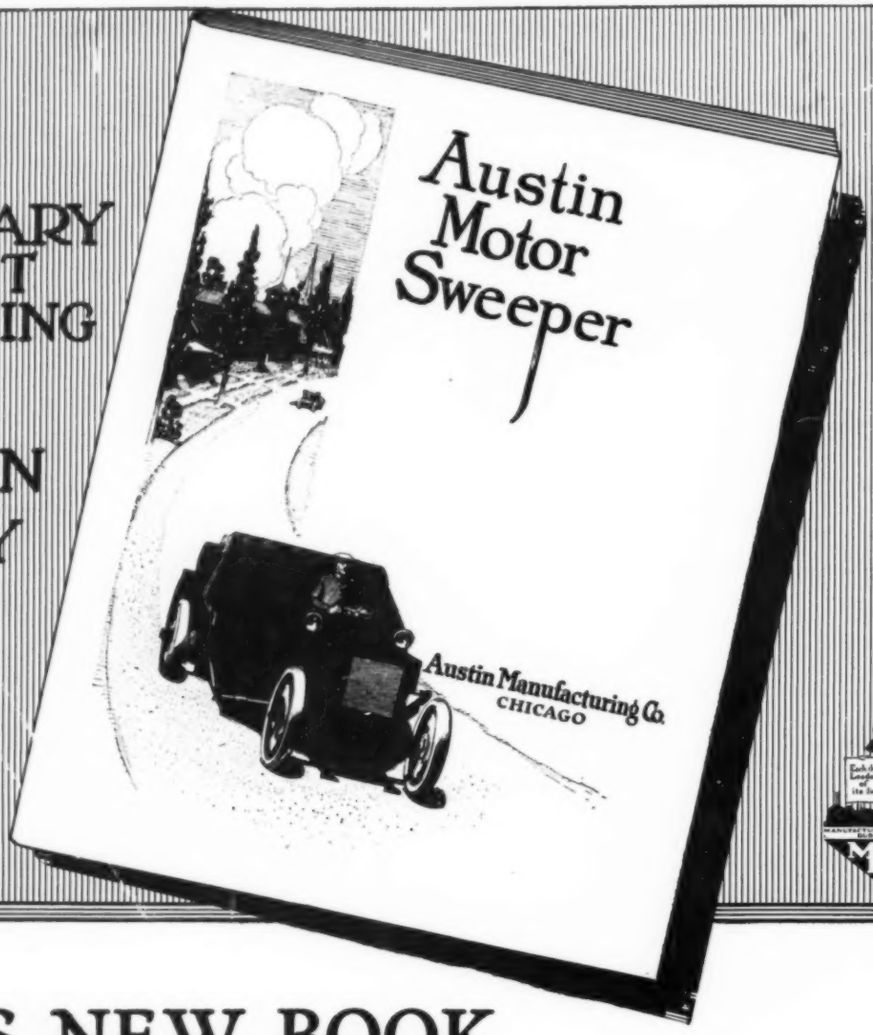
Successful Methods

Construction - Road Making - Engineering - Industrial - Mining

August 1919

Machine Grading in Minnesota

For
SANITARY STREET SWEEPING
the
MODERN WAY



THIS NEW BOOK

Tells All About the Latest Addition To the Austin Municipal Line

This new motor sweeper is a self-centered unit—only one operator required. It is self propelled. It sprinkles, sweeps, collects all kinds of street dirt in one operation. It transports and dumps. It is rapid—no dust and no noise. Ideal for night work in residential districts.

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Successful Methods

A Magazine of Construction Service

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CONSTRUCTION SERVICE

"The principal element of the cost of manufactured articles is labor," said Roger M. Babson, speaking for the United States Department of Labor.

This is just as true in the making of a highway, a building, or a drainage ditch as in the manufacture of a suit of clothes, a sewing machine, or a piece of construction machinery.

The cost of living and the number of men available determine the wages of labor, and the wages of labor in turn determine the price of a manufactured product, whether it be a road or a piece of machinery. It has been found that 85% of the cost of producing steel is labor cost.

The solution of the problem of high labor prices lies in the wide use of labor-saving machinery and in the rapid development and production of labor-saving machines to fit the needs of the times.

In the use of labor-saving machinery detailed knowledge of actual facts, exact conditions and the successful methods used to meet these conditions are of infinite value. You know the value of such information. The editors of SUCCESSFUL METHODS realize it also and are so guided in making this magazine.

Construction service consists not only in the manufacturers installing modern labor-saving machinery in their own factories in order to reduce manufacturing costs, but in seeing to it that the users of their manufactured product obtain the maximum benefit from the use of these machines that do the work of men.

This Magazine Will Be Sent to Men Who Can Use It.

EDITORIALS

Plant Depreciation

SEVERAL years ago the editor attempted to find out from a large number of contractors whether or not they figured plant depreciation when estimating costs, and if so, what methods they used. The answers varied in many cases from extreme evasiveness to honest indifference. From the replies he concluded that the majority of small contractors fail to figure depreciation on each job. Large contractors, on the other hand, always figure this item.

Failing to figure plant depreciation often accounts for the difference between the bidding price of the responsible and the irresponsible bidder. The responsible bidder always figures all of the cost and adds a decent profit. The irresponsible bidder frequently guesses wildly and gets the job. From that time on, he is a source of grief to himself, the engineer and the owner.

The necessity of figuring plant depreciation in a sensible way frequently has been emphasized, but it seems as the old saying has it "there is one born every day." Moreover, there are always plenty of people ready to give their work to the lowest bidder regardless of his rating.

It seems probable that this condition of affairs will not change until the public demands efficient work as well as low price. The Associated General Contractors and others are doing all in their power to remedy this condition of affairs and in time results will be obtained. But any man who wishes to stay in business must know the things that cost him money other than material and labor.

Flood Control Work Needed

ONE of the greatest needs at the present time is a definite policy for the control of floods on the rivers of the inland states. Thousands of acres of land are inundated yearly, crops are destroyed and land injured. This loss could be prevented by adequate flood control. Deepening inland waterways is by no means so important as controlling floods and protecting farms and homes.

Many states are undertaking such work. The Miami Conservancy Project is the most noteworthy example of this kind. But for the country at large, action by the National Government is necessary. Flood control and deep waterways are closely related.

Station Men in Highway Work

THE historic figure of the Irishman with his wheelbarrow and his station contract has appeared on the highways under construction near Wabasha, Minn. A. Guthrie & Co., contractors of St. Paul, Minn., who have work amounting to about $300,000 in that vicinity, are employing station men in highway work.

At one point a section of road about 1000 ft. in length and involving a single cut and fill and about 3000 cu. yd. of mixed earth and loose rock excavation is being built by 5 station men. The company furnishes these men with two 1½ cu. yd. side dump cars and a horse, and also supplies them with sufficient 2-ft. gauge 20-lb. rail for carrying on the work.

This is the most satisfactory method of handling dirt that has been found, according to J. C. Baxter, general superintendent of A. Guthrie & Co., and the company expects to work as many station men as conditions will permit.

Where Are the Materials and Machinery?

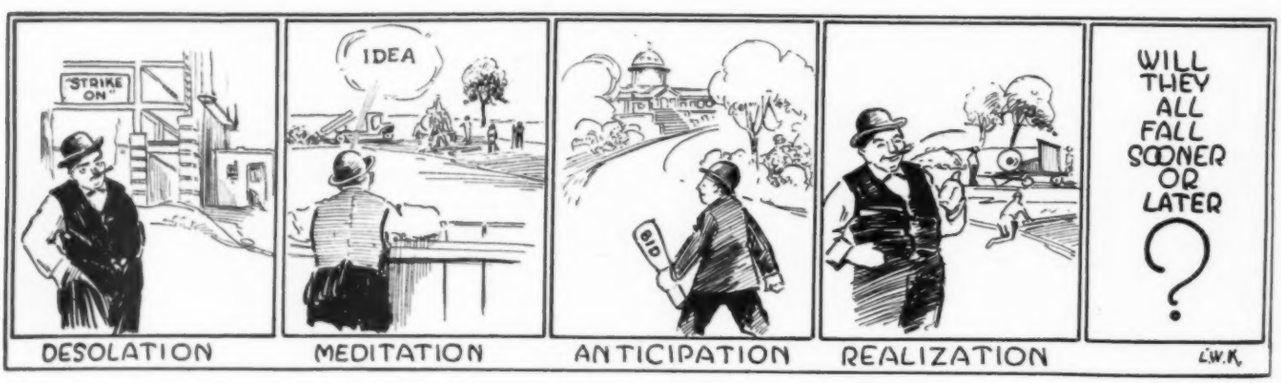
THE state of Texas has a road building program that involves the expenditure of twice as much money as will be spent in the state of Illinois for that purpose. This program will bring about in Texas a sudden and large jump in the production of materials and machinery for handling these materials. It is extremely doubtful if the material plants can handle their orders, or if the machinery manufacturers can supply the demand for machinery. On top of this, there is a great shortage of labor, making necessary the use of labor-saving machinery.

Many other states are in the same predicament as Texas, and the solution of this problem will necessitate the establishment of many new quarries and gravel pits and the intensive production of adequate labor-saving machinery.

New Use for Liberty Bonds

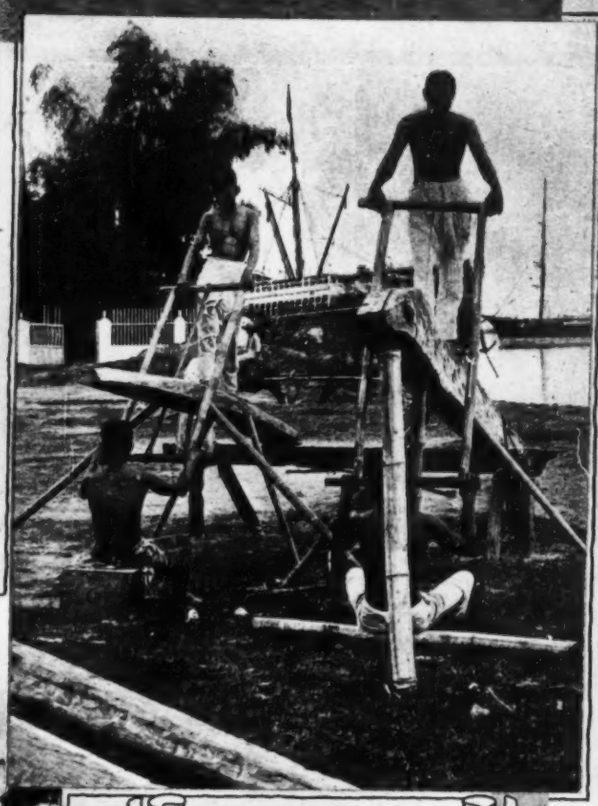
A CONTRACTOR in St. Paul, Minn., bought Liberty bonds in open market and used them instead of a bonding company bond on a big road construction job.

The bonds were a good buy at market price he thought and the 1.5% charged by the bonding company was saved and added to his profit on the job.



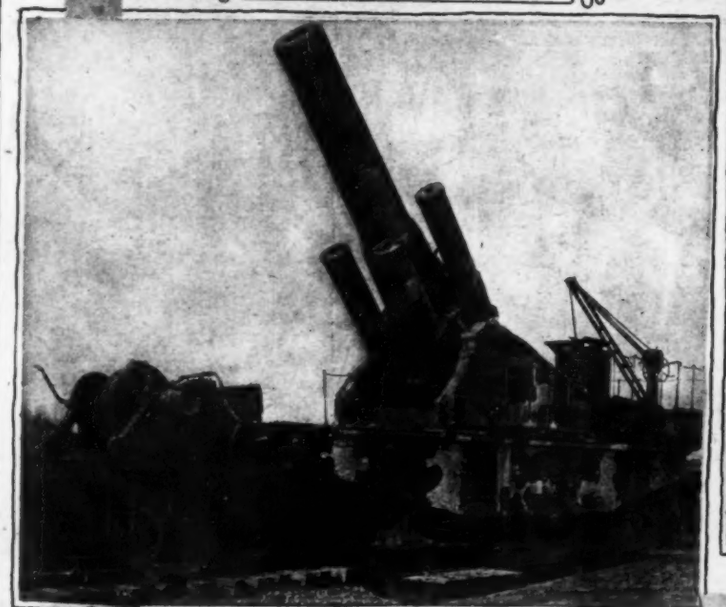
MACHINERY EVERYWHERE

SHOVELS BY MAIL
The modern postman balks at nothing and a shovel is handy sometimes



FILIPINO SAW MILLS
How much do these mills cut a day? Modern methods are needed.

AN AMERICAN SAW MILL IN FRANCE
This mill cuts 20 thousand feet a day. Contrast the Filipino saw mills

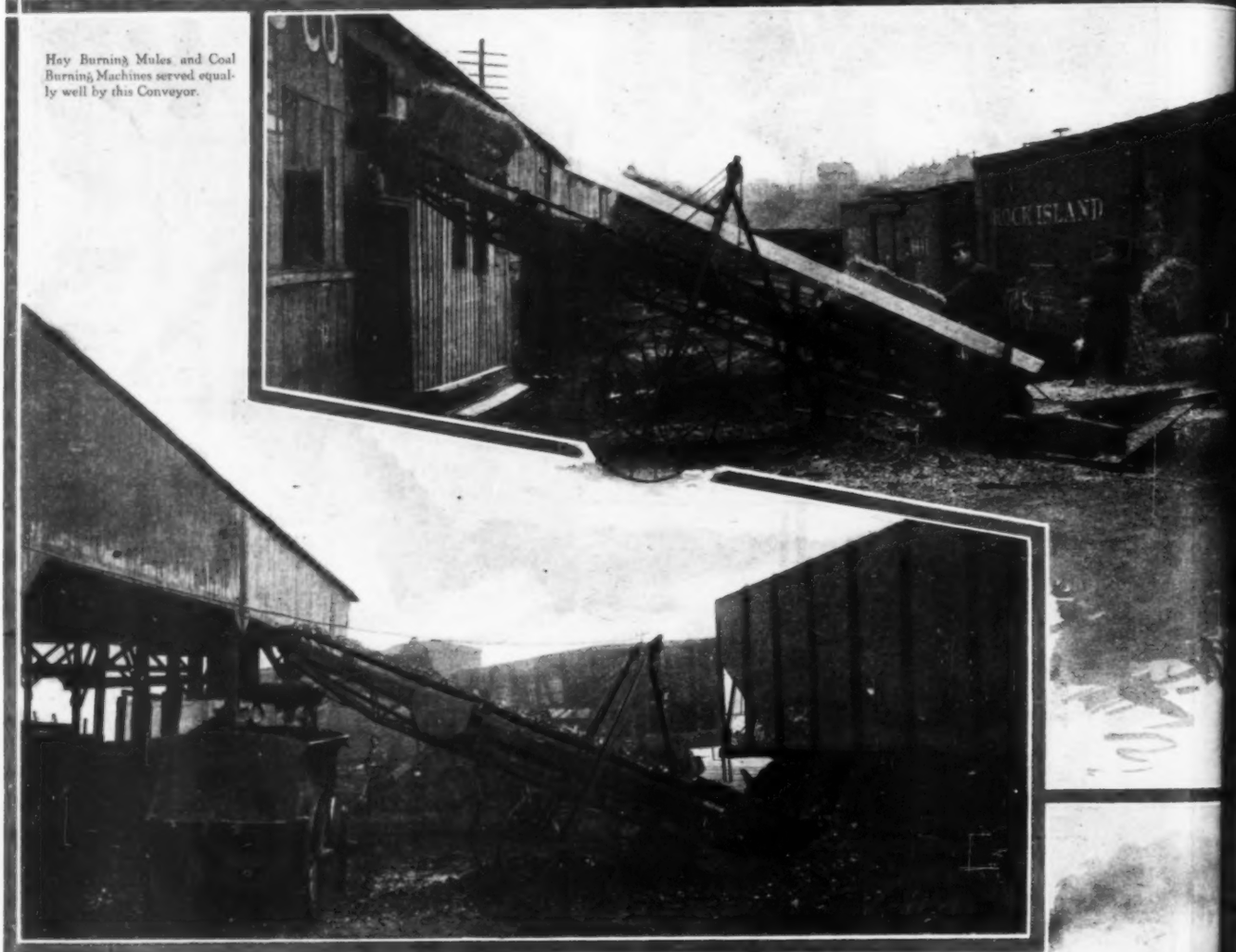


THE BRIDLE OF THE WAR MONSTER
Heavy railroad artillery is handled by hoisting engines

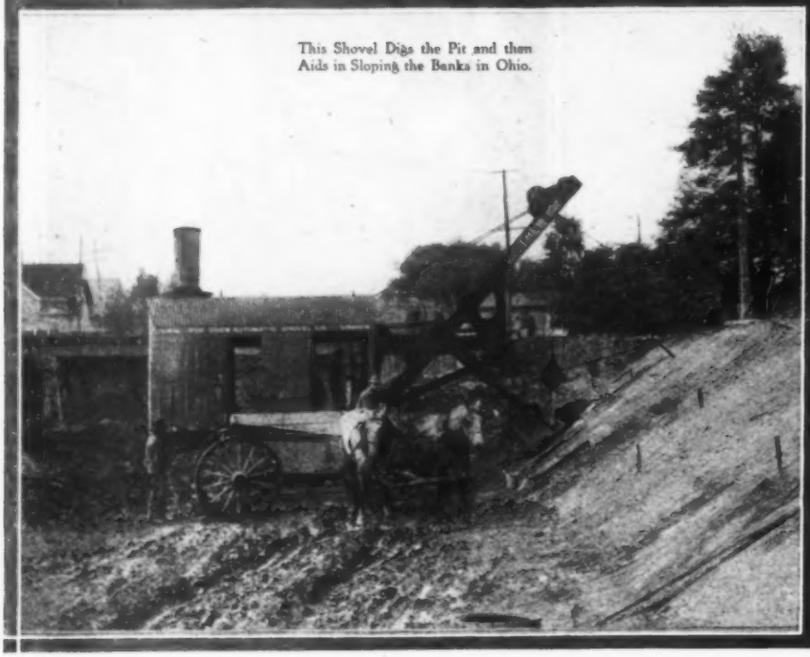
ANTICIPATING WINTER COAL SHORTAGE
From the shovel to the conveyor to the storage pile with little labor

© Underwood & Underwood, N.Y.

FIT THE TOOL



Hay Burning Mules and Coal Burning Machines served equally well by this Conveyor.

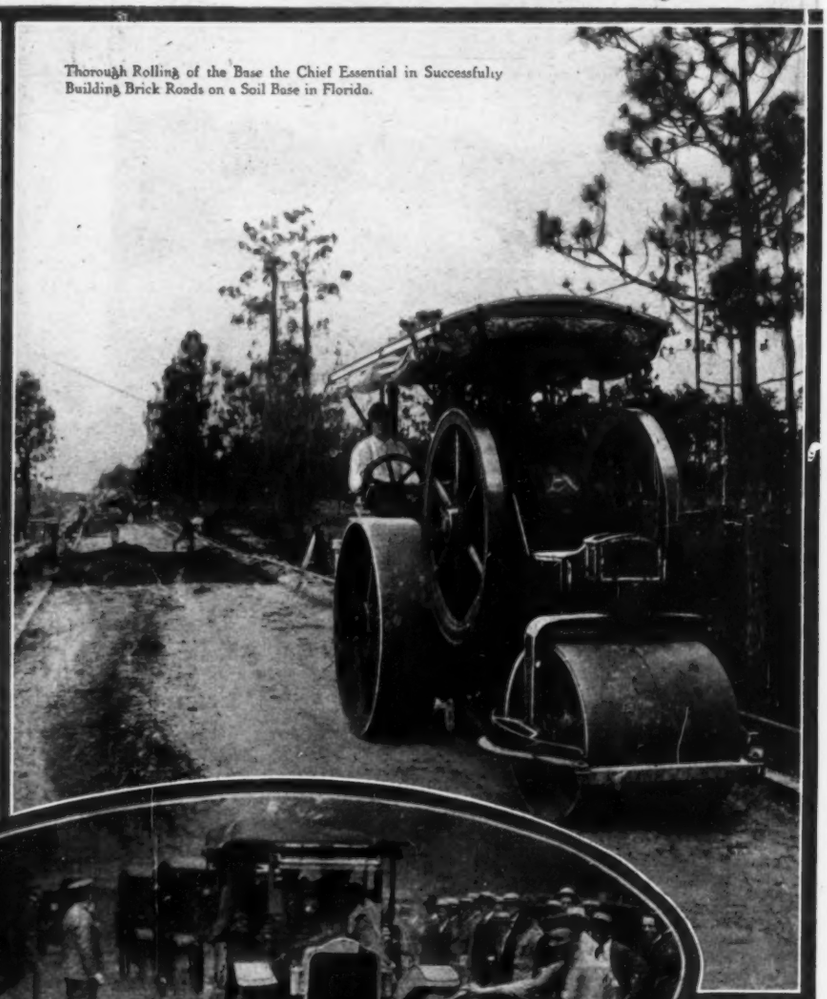


This Shovel Digs the Pit and then Aids in Sloping the Banks in Ohio.

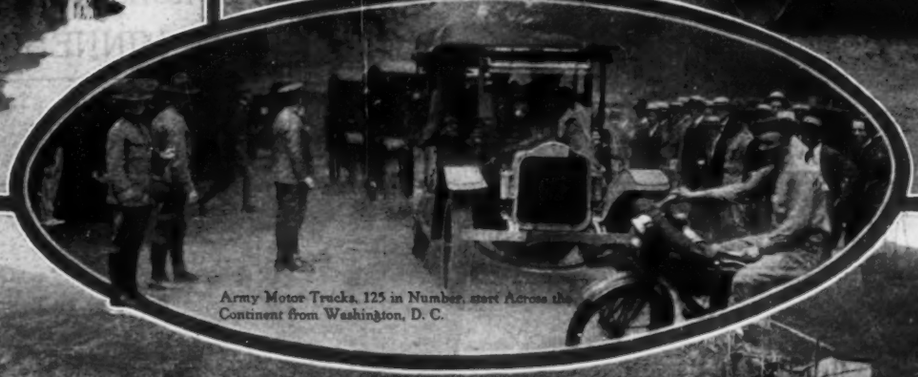
Handling Earth into Railroad Cars on Grade Separation work near Chicago.

TO THE JOB

Trenching in Extra Frozen Soil Four Deep in New York.

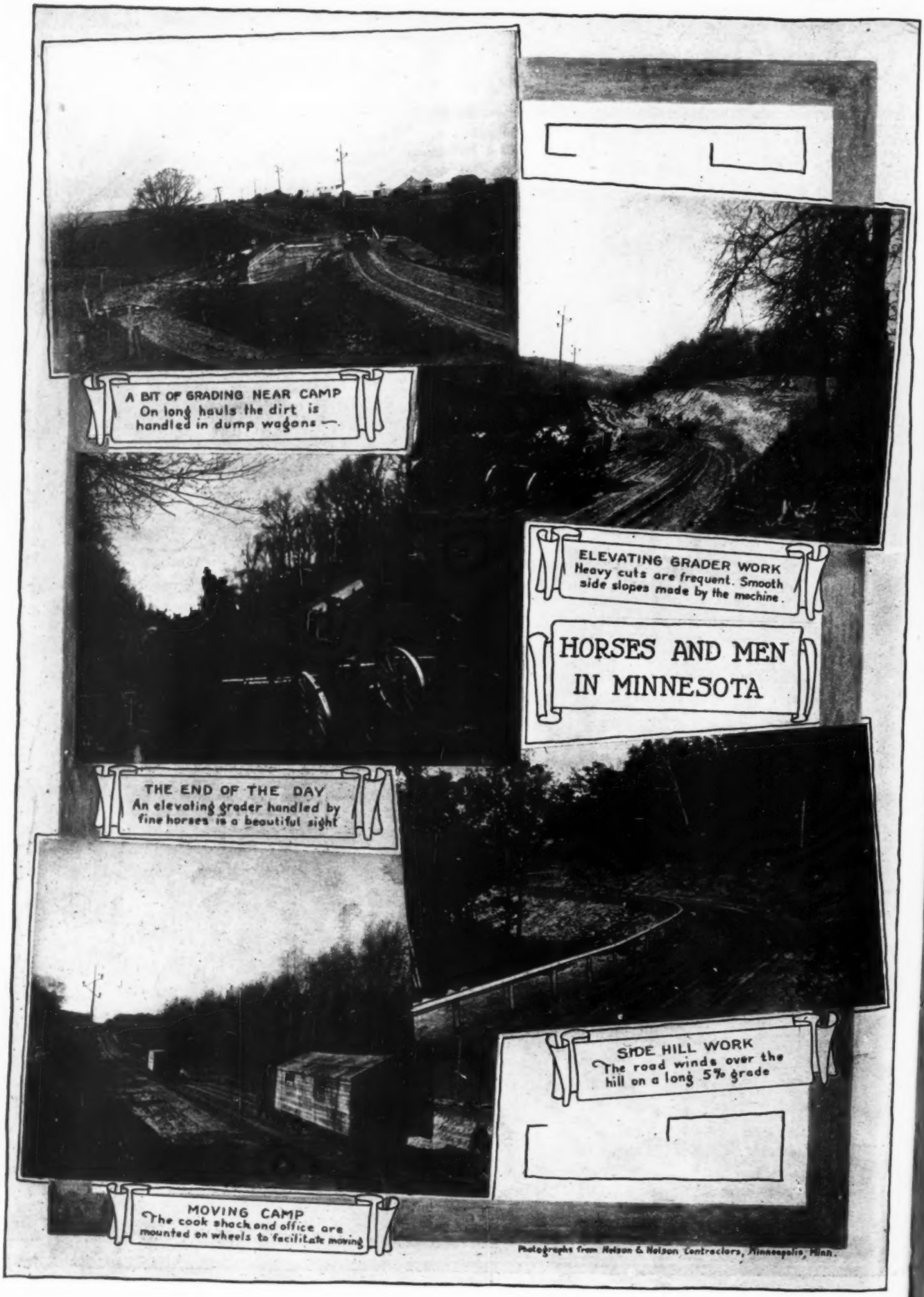


Thorough Rolling of the Base the Chief Essential in Successfully Building Brick Roads on a Soil Base in Florida.

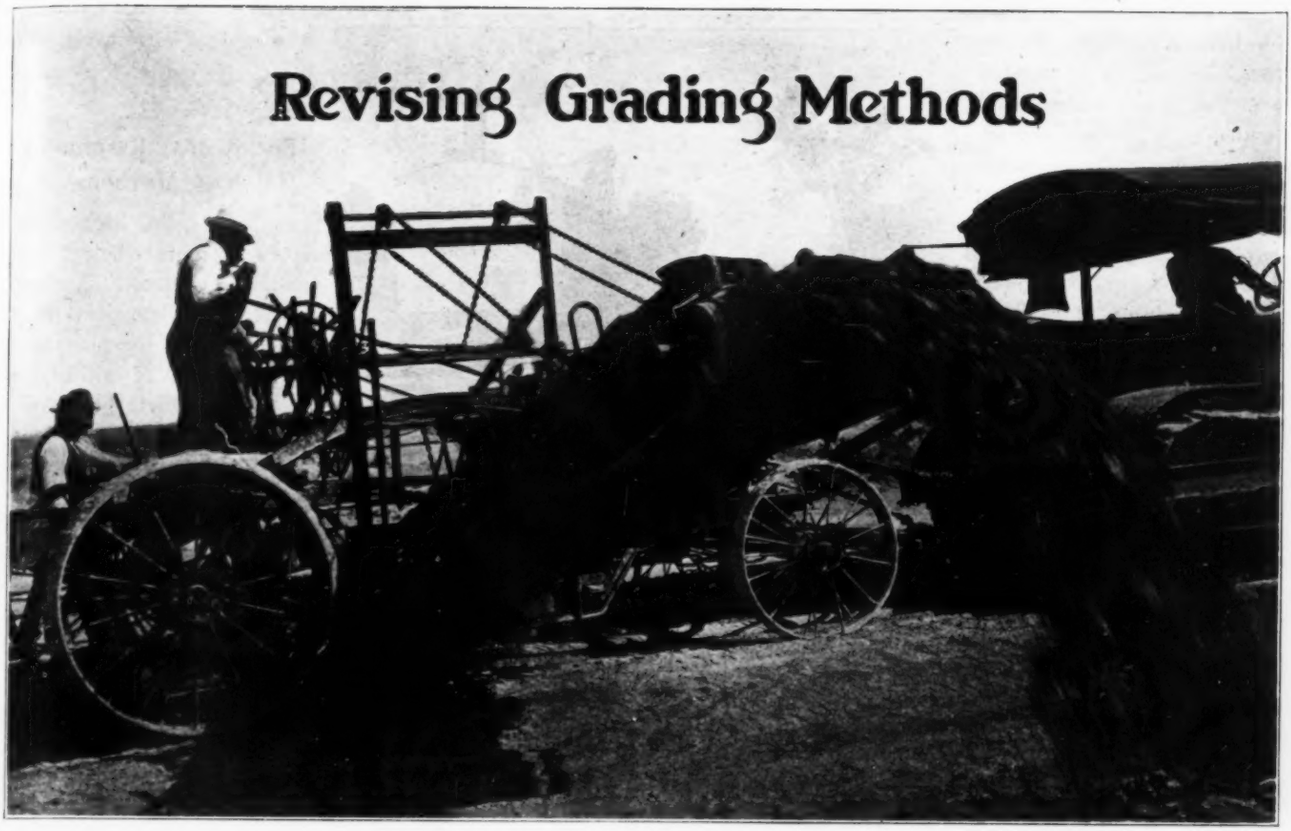


Army Motor Trucks, 125 in Number, start Across the Continent from Washington, D. C.

The Tunnel Mouth and the Tools, Machinery Did the Work on Shattuck & Edinger Co.'s job near San Francisco.


A BIT OF GRADING NEAR CAMP
On long hauls the dirt is handled in dump wagons.
ELEVATING GRADER WORK
Heavy cuts are frequent. Smooth side slopes made by the machine.
HORSES AND MEN IN MINNESOTA
THE END OF THE DAY
An elevating grader handled by fine horses is a beautiful sight
SIDE HILL WORK
The road winds over the hill on a long 5% grade
MOVING CAMP
The cook shack and office are mounted on wheels to facilitate moving
Photographs from Nelson & Nelson Contractors, Minneapolis, Minn.

Revising Grading Methods



The great change in labor conditions which has been brought about within the last few years has made necessary the more extensive use of labor saving machinery and has resulted in the creation of many new methods and devices to offset labor shortage.

"WHAT do you consider the most pressing needs in the way of new machinery for grading work?" was the question asked of W. A. Rogers, president of the Bates & Rogers Construction Co. of Chicago, a firm whose operations run into millions each year.

"A few years ago I could have answered that question readily," replied Mr. Rogers, "but now I do not know what to say."

An article by Halbert P. Gillette, in the July issue of SUCCESSFUL METHODS, called attention to the fact that high labor prices usually brought about an increased use of labor saving machinery, and that because of this, contractors in the Western States have always made greater use of machinery than they have in the Eastern States.

Labor was formerly the chief item in the cost of handling earth, and labor still is the most important factor. But in many cases man power is not available, and it is then that the use of machinery to take the place of men becomes imperative.

GRADING FOR HIGHWAY WORK

The problems of highway grading differ materially from those involved in railroad, drainage and irrigation work. As a rule, cuts and fills are shallow. The number of square yards of trimming per cubic yard of earth moved is much greater than in any other class of work, and the methods used must be selected with these facts in mind. Some years ago practically all this work was done with teams and a few pieces of machinery. Now, new and improved methods have been developed to suit the special conditions that are found on each job.

One of the most difficult problems in grading for concrete roads is the tearing up and removing of the existing road surface. In this case, the method would vary according to the degree of hardness of the surface and the size of the job. Perhaps the most satisfactory method will be found in the use of the steam shovel. Various new and efficient ways of scarifying and loosening this surface have been devised. Scarifiers are attached to monster road machines and pneumatic scarifiers attached to steam rollers are used. A contractor attempted to break up old macadam road by hitching 2 rollers to a large road machine with a scarifier attachment, leaving all the teeth in the scarifier. The result was by no means satisfactory. A more effective method in use by other contractors employed 2 rollers with 2 rooter plows to each roller and a road machine to remove loosened material. A pneumatic scarifier attached to the roller would have done the work rapidly and successfully. A frequent mistake is to attempt to scarify with all the teeth in the scarifier.

IMPROVED EQUIPMENT AND NEW METHODS

There is a multitude of tools for handling earth, some of which are old and can be improved, others of which are new and have a value yet to be determined. The simplest tool for handling earth is the shovel. Under cheap labor conditions, many contractors cared to have only one type of shovel on the job and that was usually a short-handled No. 2 "billy." Under higher priced labor conditions it has become necessary to use many different types of shovels.

Plows have been specially equipped so that they can be handled by traction engines. Traction scrapers and wheeled scrapers have been modified so at to fit them for

mechanical haulage. In one case, a gang of 5 wheeled scrapers was loaded and hauled by a traction engine. In another case, a small traction engine is handling a No. 00 drag scraper in excavating for a building and is doing the work efficiently. Road machines have been modified for mechanical haulage, have been increased in size, and various rooting and scarifying attachments provided.

DIGGING A ROAD DITCH WITH A STEAM SHOVEL

The development of the steam shovel probably has had more effect upon earth handling methods than any other one factor. A shovel outfit used in conjunction with track and cars reduces the labor required on a job to a minimum. Shovels are manufactured with varying lengths of boom for special work, and equipped with new features, which greatly increase their range of utility. New types of cars for handling earth are also in use.

The elevating grader was invented and put in use several years ago. Within the last couple of years there has been a marked increase in the number in use, and it is finding a place on a greater variety of jobs each season.

Wagons have been improved in design and elements of strength have been added. The motor driven dirt wagon is a development of the future, for which there now exists a crying need.

Special Earth Handling Machines

For levee and reservoir work and for the excavation of sewers and trenches, the last few years have brougth forth many important developments. The coming of the drag line has changed heavy earth work in a limited space from a man and team job to a machine job with a remarkable reduction in the amount of man labor and horse-flesh required. The Mississippi levees formerly were built by men and teams; now, they are being built very largely by machinery. In the Miami Conservancy District drag lines are handling the earth several times, being used to transport as well as to excavate, and the work that they are doing is proving efficient and satisfactory.

Drainage work is now almost entirely machine work where formerly it was doneby hand. A few men and a machine have taken the place of many low-priced laborers.

Economical Results of New Methods

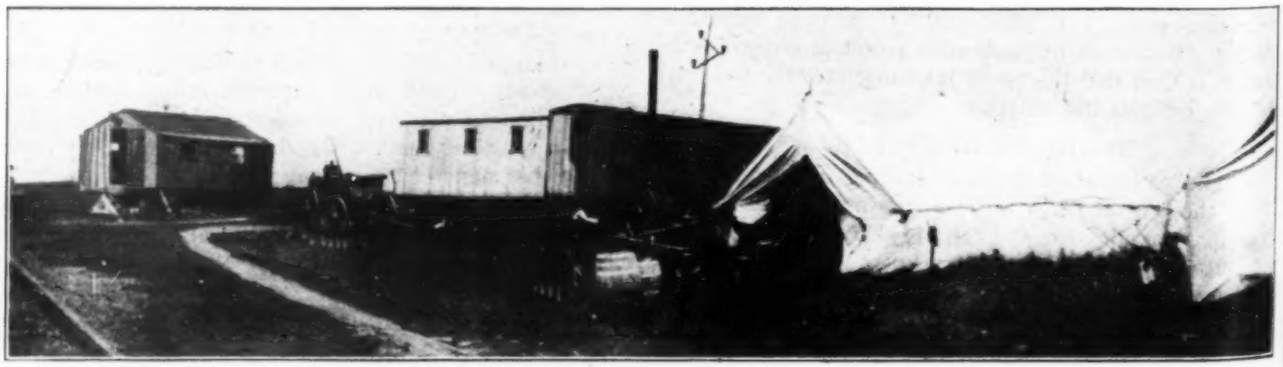
As a rule, high-priced labor is more efficient and easier to control than cheap labor. The substitution of machines and few men for a great amount of hand labor has simplified the labor situation to some extent. Necessity was the mother of this change, and the change was not made until conditions forced it.

We have already entered upon a period of labor-saving devices. This results in a large investment for plant with an increasingly low investment for labor. While machines are perverse, perhaps, and have to be repaired, hand labor is human and on the whole, much more difficult to control. The effect of large plant investment on the construction field will be a greater specialization among contractors. The man who is equipped with plant for a special kind of construction work must stick to that class of work. He cannot hire and fire machinery as men have been hired and fired in the past.

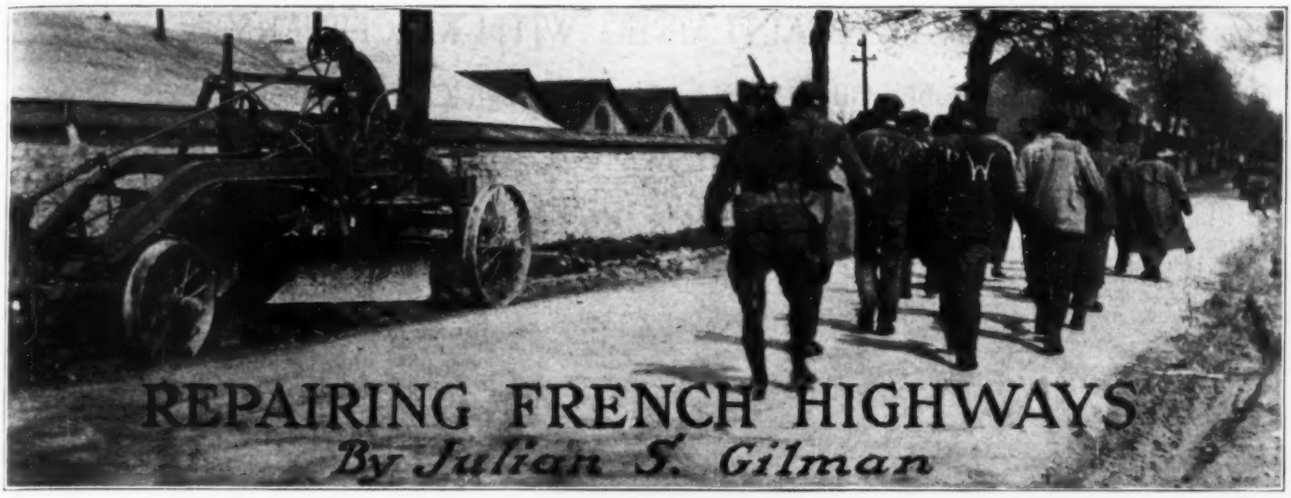
Developments of the Future

There is a need for many new kinds of earth handling machinery. A satisfactory combined plow and excavator has yet to be evolved. This may be a development of the steam shovel or an entirely new machine. There is a definite need for a power driven scraping grader for highway work. New kinds of cars which can both excavate and transport earth are needed. Loading devices innumerable are being worked out, and buckets with cableways extended in application for new types of work.

"I have in mind," said J. C. Baxter, general superintendent for A. Guthrie & Co., general contractors of St. Paul, Minn., "a dirt moving job where no horses will be used. Elevating graders will be hauled by mechanical power, perhaps self-contained, and not strung out ahead as at present. Earth will be loaded in power dirt wagons which will be driven to the dump at one speed and back at a faster speed. Plows will be drawn with tractors. In fact, the whole job will be motor driven. I believe the realization of the dream is but a short time off."



OFFICE, COOK SHACK AND EATING HOUSE USED ON AN EARTH MOVING JOB



REPAIRING FRENCH HIGHWAYS

By Julian S. Gilman

THE secret of good roads in France is the same as elsewhere: Drainage. Those roads which are crowned properly have stood the severe test of the last 4 years exceedingly well and need little repair. On the other hand, those that were not built under this plan have proved unsatisfactory.

Many roads in use today were built by the Gauls and Romans who completed a system radiating from Lyon, the Roman capital. The old Roman roads are well drained and have foundations one or more feet deep. In cities, particularly at Lyon, the old streets are built of small round stones the size of one's fist, imbedded in cement and present a polish as of marble where the traffic is not heavy.

Here let me make mention of a fact so important it should be instilled into the minds of everyone, especially children. France, since the beginning of time, has been a trading ground. It is just as natural for French to bargain as it is for them to drink "vin rouge." Americans have greatly misunderstood this method of exchange and have considered they were being robbed when, as a matter of custom, they had not bargained for their goods and, consequently, they purchased at the price quoted. A true Frenchman, or Frenchwoman, much enjoys a trade.

I mention the above in passing, on account of the adverse criticisms I have heard at different times of the French and their method of doing business with the soldiers. It has been most unfortunate, at times, and I have suffered myself in several instances, but the French, themselves, are today more than ever paying the same price as the Americans and others for all supplies.

The roads of France have been built primarily for military purposes and are very straight. You can travel mile after mile on a road that seldom turns except to descend from a hill. Roads developed locally generally avoid the hills and hence hardly ever are straight.

France has some 400,000 miles of paved highways of many types. Crushed limestone macadam is more generally used. Stone block pavement is also used a great deal in the cities and in the suburbs. The older towns are nearly all paved with stone blocks. Wood blocks are used extensively in Paris and a few in the large cities.

Paris has more kinds of paving than any city in the world, good, bad and indifferent. Even on the older streets, which are only wide enough for pedestrians, you find the old stone block paving. The Champs Elysees is paved with the wood block on a concrete base. This beautiful boulevard extends from the Place de la Concorde to the Arc de Triomphe and is perhaps the most famous, as well as the most beautiful avenue in the world. It is something over a mile in length and straight as an arrow. The roadway is approximately 100 ft. wide; then comes a parking containing trees; then a 6-ft. sidewalk, another parking and another sidewalk 5-ft. wide. It was here the Germans camped in 1870 and it is here the peace parade marched.

The roads of France, however, were never intended for heavy truck service. Particularly along the convoy routes you will find them in very bad condition. The question of drainage, however, has had much to do with the breaking down of the same. At the present time, 11 companies of engineers are repairing the damage to roads by A. E. F. traffic. In the base sections alone there are something over 700 miles of roads to be repaired. There is also a plan under way to pay the French Government a certain sum of money, and let them do the repairing with their own forces.

The prospects for American machinery from my observation seem exceedingly bright. Many rock crushing outfits will undoubtedly be needed in rebuilding the roads, streets and buildings of the devastated districts. In cleaning up the small towns, light dump wagons and carts can be used to splendid advantage. Other equipment such as small dump cars, steam shovels, locomotive cranes, scarifiers, rollers and rooters will also be used.

In the development of the canal system the elevating grader with its simplicity of operation and great efficiency of service should play a most important part. This machine is entirely different from anything in use in France at present and will certainly prove of wonderful value in the hands of the thrifty French, once they learn its use.

In closing, I desire to pay tribute to "Jack" and "Jennie," who have battled so valiantly for Democracy's cause. Some 60,000 strong they came and conquered and now the sad news is made public that they have decided to remain over there and assist in the reconstruction work. This means, of course, that there will be a large demand for American equipment for mules are wise, especially army mules, contrary to the understanding of many people; they know what they want and generally kick until they get it.

HIGHWAYS MAINTAINED WITH MACHINERY

How Public Officials Can Meet the High Cost of Labor

By N. DeWind

PUBLIC officials throughout the country are sooner or later confronted with maintenance problems in country roads. It is generally accepted now that when a road is built, no matter how well, it cannot be left to take care of itself.

The proverbial "stitch in time that saves nine" applies more to road maintenance than to any other public utility. Highways are constantly exposed to the abrasive action of wheel traffic as well as the natural disintegration caused by climatic changes.

It is natural for the public officials to shrink from making much expenditure on a road after it has been built or improved at considerable initial cost. There is always a feeling that it does not look well on the records to be spending money on something newly built, although they know that proper maintenance is the truest economy.

Up-to-date labor-saving equipment has come to the rescue of this situation and it is now quite possible for 2 or 3 men equipped with the proper machinery to repair and maintain county roads at a surprisingly low cost in dollars per mile.

Not only can the surface be saved from rutting and pot holes but the side drains can be kept open and the borders free from excessive plant growth, thus insuring proper drainage and the distribution of traffic over all parts of the road surface.

MAINTENANCE NEEDED

MAINTENANCE APPLIED

MAINTENANCE RESULTS

BLASTING BOULDERS

Boulders encountered in excavating the Cape Cod Canal, were located by sweeping and by divers, and were removed either by hoisting in slings, attached by the divers, by large steam lighters, or were broken by blasting and the pieces disposed of.

The blasting was done usually by placing charges of dynamite on top of the boulder, depending on the overlying water to act as tamping. The explosive used was 75% gelatine dynamite, the charge varying from 25 to 200 lb. The best results seemed to be produced by charges of about 50 lb., even if they had to be repeated, the second and subsequent charges being inserted in the fissures made by the first.

Boulders as large as 80 tons were thus disposed of.

TRAP MAKES STORAGE PILE

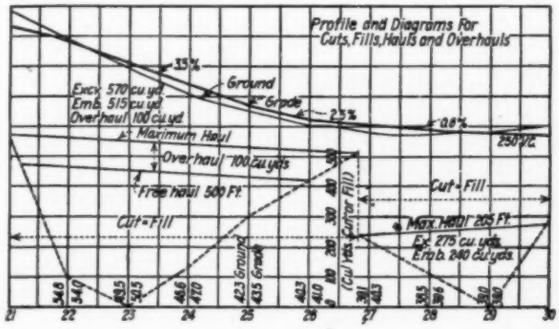
A most striking use of dump wagons and a trap was made in the distribution of coal to the various heating and power units scattered through Camp Grant, Illinois. Traps are in common use for loading material but have seldom been used for unloading, and making storage piles.

In the foregoing instance the coal was loaded at the siding into dump wagons and hauled to various points. There the teams were driven up an incline to the trap into which loads were dumped, and then down again on the other side. The plan worked exceedingly well. From time to time the trap was moved so as to permit the enlarging of the storage pile, and the move was easily made.

OVERHAUL IN ROAD CONSTRUCTION

How to Use a Mass Diagram—Simple Method Developed

THE Minnesota Highway Commission is using an unusually simple method of computing overhaul. The dotted lines show the disposition to be made of the earth. Vertically, each of the larger squares represents 100 cu. yds. Horizontally, each square measures 50 ft. of haul. The diagram was drawn by adding the fills and subtracting the cuts between successive stations and plotting the algebraic sum obtained at each station. This makes a diagram which slopes downward for cuts and upward for fills.



QUANTITIES ARE COMPUTED SEPARATELY FOR EACH SECTION OF EQUAL EXCAVATION AND EMBANKMENT.

For example, at Station 21 there were 585 cu. yds. cut. At Station 22 there were 480 cu. yds. cut. The difference between these two quantities is 105, therefore the point is plotted to indicate 105 cu. yd. difference. Lines are drawn connecting all points.

Since it is necessary to have more cut than fill to allow for shrinkage, the cut end is higher than the fill end of the diagram. A line is now drawn connecting the high points of the curve. If this line is level the cut and fill balance, but no allowance is made for shrinkage of fill.

If the free haul is 500 ft., another line showing "Free Haul" is drawn parallel to the line above at such a point that it will intersect the curve and scale just 500 ft. in length. The perpendicular distance between these two lines will scale the amount of overhaul.

The free haul and the maximum haul are added and divided by 2. Subtract the free haul from this result and the overhaul distance is obtained.

Then, for example:

Overhaul distance (40 ft.)	×	Overhaul yardage (100)	×	Overhaul price (2 ct.)	=	Amount due ($0.80)

This diagram besides showing the amount of overhaul is very valuable in showing the contractor where to place the dirt in making cuts and fills.

HIGHWAY FROM 6 MILES OF OLD RAILROAD GRADE

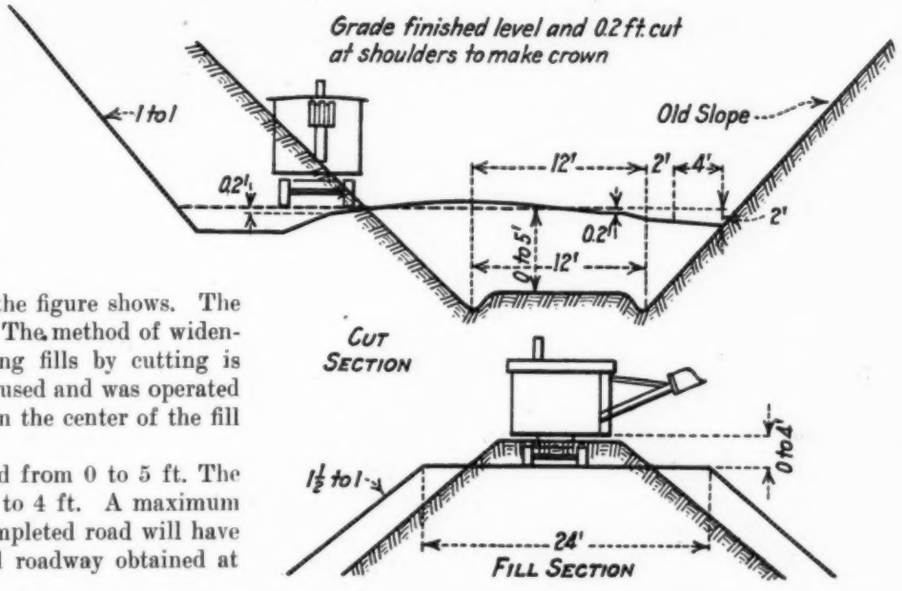
Cutting the Fills and Filling the Cuts the Method Used

THE method used by S. J. Groves & Sons, contractors of Minneapolis, Minn., is successfully converting an abandoned railway grade near Alexandria, Minn., into a highway is illustrated in the figure.

The cross section required by the Minnesota State Highway Commission called for 24 ft. width of roadway in cuts and ditches as the figure shows. The fills were to be 24 ft. wide on top. The method of widening cuts by filling and of widening fills by cutting is clearly shown. A steam shovel was used and was operated in the ditch in widening cuts and in the center of the fill in lowering fills.

The fill required in cuts varied from 0 to 5 ft. The cut required on fills varied from 0 to 4 ft. A maximum grade of 2% was secured. The completed road will have a good location and a well drained roadway obtained at a minimum of cost.

There are hundreds of miles of abandoned railroad grade that can be made into highways by this method.



METHOD OF CONVERTING AN ABANDONED RAILROAD GRADE INTO A HIGHWAY

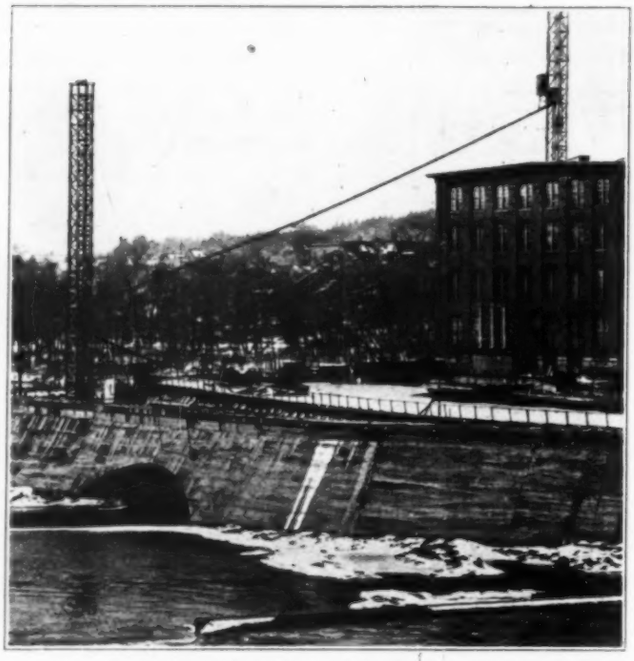
SPOUTING PLANT BUILDS KENNEBEC DAM

Forms Made in Steam Heated Plant for Lockwood Mills Hydro-Electric Plant at Waterville, Maine—Crib Cofferdam Desirable for Head Over 10 Ft.

By E. E. Sanders
President, Sanders Engineering Company, Portland, Me.

LOW costs were obtained and good progress made on the cofferdam built last winter as part of the hydro-electric development for the Lockwood Mills on the Kennebec River at Waterville, Maine. Work on the cofferdam was begun in November, 1918, and it was ready for pumps about January 15 of this year.

The cofferdam as shown in Fig. 1 is built on four sides enclosing an area approximately 200 by 300 ft. On the down stream sides, crib work is used, 15 ft. wide by 16 ft. high with a 5 ft. sealing space. The other two sides are of ordinary box type, 12 ft. by 10 ft. to 16 ft. high.



CANAL RETAINING WALL, CONCRETE PLANT AND CABLEWAY TAIL TOWER

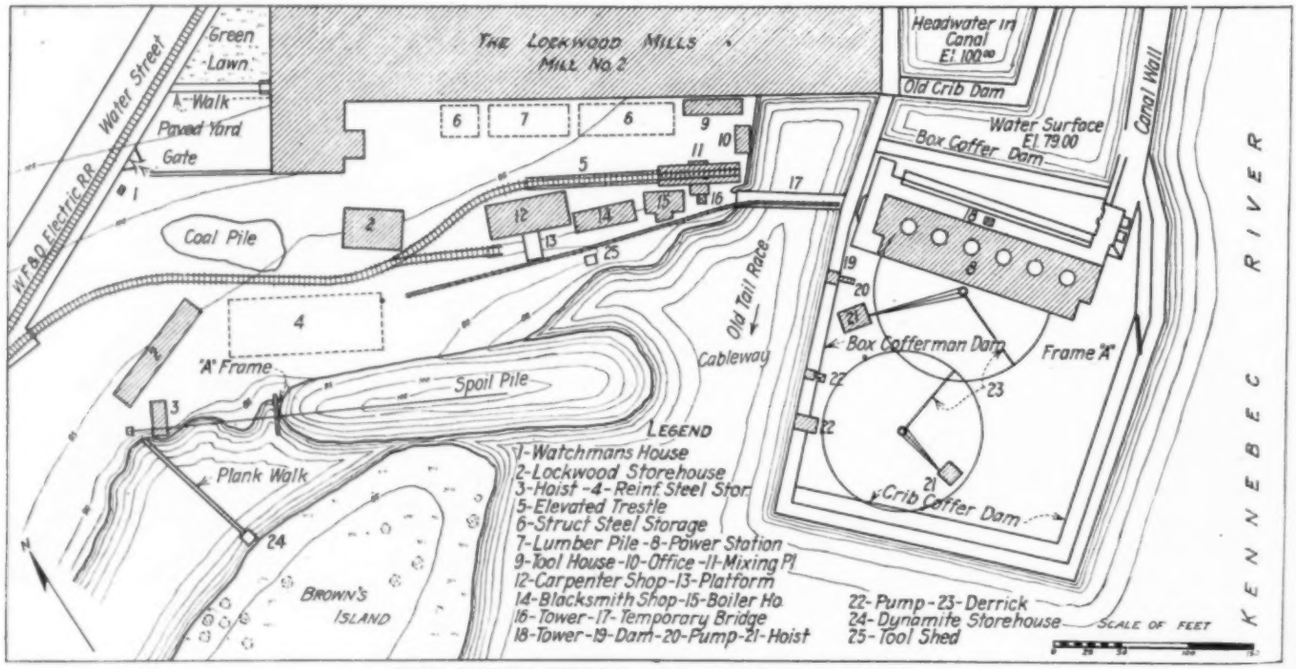
The water on this particular part of the Kennebec is about 10 feet deep, but with little rain, especially in the spring of the year, rises from 3 to 10 ft., but our cofferdam had an 8 ft. free board, consequently we were flooded only once. We used two 8 by 10 in. centrifugal pumps connected with 25 hp. motors for regular service, and one 10 by 12 in. on a 40 hp. for emergency. Ordinarily one of the 8 by 10 in. pumps would keep the cofferdam dry working under a 22 ft. head, with about 12 ft. suction.

The labor cost of placing timber and driving planks from 2 ft. to 5 ft. averaged $28 per M. board ft., and that of placing stone and sealing fill about $3 per cubic yard.

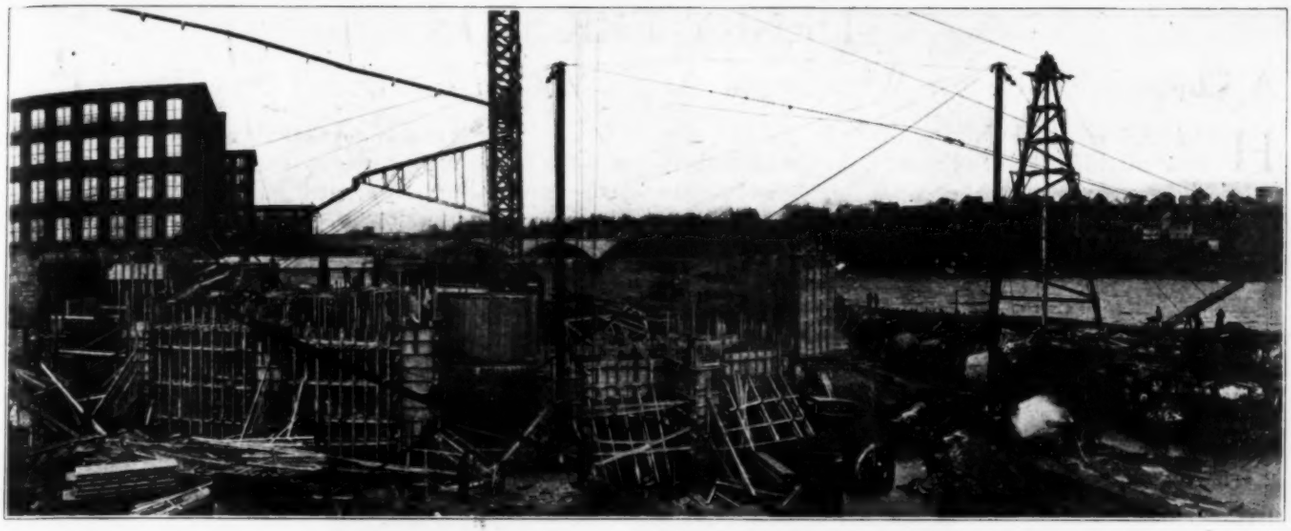
Our experience on this job indicates that a box cofferdam is not safe for more than a 10 ft. head without a large amount of crib supports and bracing. If we again have occasion to build cofferdams of similar height we shall make them all crib cofferdams.

By referring to the map, it will be seen that a tail race 150 ft. wide separates the station from the shore side. Consequently, we either had to build a trestle or use a cableway to carry the excavation material ashore. We chose the latter method, rigging up a 5 ton cableway 800 ft. span, and it worked successfully.

We excavated about 6,000 cu. yd. of ledge rock and



THIS SHOWS WHERE THE WORK WAS DONE



GENERAL VIEW OF LOCKWOOD MILL JOB, WHEN ABOUT 1,700 CU. YD. OF CONCRETE WERE IN PLACE.

4,000 cu. yd. of earth between Jan. 20 and May 1 at a labor cost, including drilling, thawing and piping, of $3 a cu. yd. for ledge rock and $2.50 a cu. yd. for earth respectively.

Much of the saving in costs was effected by the use of a spouting type concrete conveying plant. It consisted of a tower 165 ft. high at the mixer from which it was spouted 220 ft. to a distributing tower 110 ft. high, standing, as shown on the map, in front of the building equidistant from each end. From this tower it is distributed by means of spouts and a 50-ft. boom, turning 180°, with a 30-ft. swivel section attached to the end of the boom spout. The pouring of concrete was started on the foundation February 25, and on May 1, 5,500 cu. yd. had been placed at a cost for labor including heating, protection, cleaning and stripping stops of 90 ct. per cubic yard.

The gravel used for the concrete is carried from the pit in a 12 cu. yd. capacity electric car making from ten to fourteen trips a day. Loading equipment at the pit includes a derrick, a ¾-cu. yd. clamshell bucket and a bin. On the other end it is hauled up a 12-ft. trestle and unloaded in two bins of a combined capacity of 240 cu. yd. Each bin is provided with three radial gates which dump into a 1 cu. yd. capacity scoop car run on a 24-ft. gauge track. This car dumps directly into the loading hopper of the mixer.

The cement for daily use is stored between two bins on a level of 8 ft. above the mixer platform and is dumped directly from that level through a spout into the loading hopper of a 21 cu. ft. mixer.

The main steam plant consists of two 60 hp. horizontal boilers. This plant was used to run 3 steam drills, to heat the concrete material, and to run the ¾-cu. yd. mixer and the hoisting engine for the concrete tower; also to do all other heating and thawing incidental to a winter's job. The biggest day's run of concrete was 270 cu. yd. in a 9-hr. day.

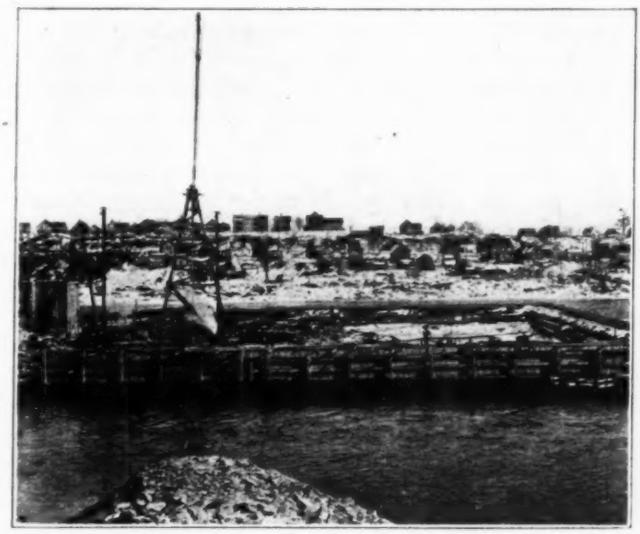
Two 60-ft. guy derricks with 1½-cu. yd. stone skips with a 20-hp. hoist, with boilers attached were used for drilling the ledge, and the largest blast put off was one of 32 holes averaging 11 ft. deep.

The forms are made up in a steam heated shop, built for the purpose, and in the opinion of the men in charge the plan was a success. Especially when work is done in the winter, it pays to build adequate shops for carpentry, machine work and blacksmith work.

The total work of the development include a canal wall 500 ft. long, containing 5,000 cu. yd. of concrete finished in November, 1918, and a 6-unit power station with 51-in. vertical water wheels, developing about 10,000 hp. The dimensions of the substructure below the generator room floor are 180 by 60 ft., containing 7,000 cu. yd. of concrete and 150,000 sq. ft. of forms, and the station of reinforced concrete 171 by 61 by 40 ft. high, containing about 1,000 cu. yd. of concrete and 60,000 sq. ft. of forms. There is also a 120-ft. span steel bridge in connection with the station with about 5,000 cu. yd. of approach fill.

The wages paid to common labor are $3.96 per 9-hr. day and 50 ct. to 65 ct. per hr. for carpenters, riggers and other mechanics. Between 200 and 250 men are employed on the job.

I. W. Jones & Co., of Milton, N. H., are the designing engineers and J. B. Downey is the resident engineer. The Sanders Engineering Co., of Portland, Me., are the general contractors and J. S. Garland is the construction superintendent.



COFFERDAM FROM SPOIL PILE AFTER ABOUT 3,000 CU. YD. OF MATERIAL HAD BEEN EXCAVATED

HENRY ERICSSON

A Chicago Contractor Who Began At the Bottom But Didn't Stay There Long

HELPING people skyward seems to be the task that Fate allotted to Henry Ericsson. Under his father's guidance in Sweden he began to prepare for the ministry despite his own preference for engineering work. What others probably called a stroke of ill fortune made it impossible for him to continue his college work and gave him a chance to follow his own inclinations. A few years later he came to America, and when they began to build skyscrapers in Chicago the men with the contracts to let turned to Henry Ericsson's firm. Whether or not his early preparation for the job of sky pilot helped him in the work of building skyscrapers is a question which the reader will have to determine for himself.

HENRY ERICSSON

Henry Ericsson was only 19 when he came to America about 36 years ago. For two years after giving up his studies he had worked for a builder and as foreman for an architect in Stockholm, so when he reached this side of the Atlantic he went to Chicago and found employment with a relative, who was in the building business. He began as a carpenter and worked most of the summer on a building on 48th street. He did good work, too, but in the fall a friend of his relative came along, and evidently the relative had conscientious objections to nepotism, for he fired young Ericsson and handed the job to the friend.

In his parting speech the kind relative assured Mr. Ericsson that he would have no trouble in finding another job, a statement which had more truth in it than the maker thought it had. Being a wise young man, Mr. Ericsson looked for a job in the outlying sections where new buildings were most plentiful and his travels took him to Oak Park, where he discovered a Scotchman named Rutherford putting up some houses.

"What can you do?" was the Scotchman's question when Mr. Ericsson, in halting English, had finished asking for a job.

"I can work hard and long," was the reply, and it must have been the right one, for Rutherford told him to begin work at once.

That evening the boss took his new man home with him, home being a boarding house, and after dinner, started out to measure some brick work for which he was to be paid according to the quantity of brick that had been laid. Young Ericsson trailed along to help out and when the measuring began found that his new boss was cheating himself by using a wrong system of measurement. He soon showed Rutherford that Swedish figures were just the same as American ones, even if they did have different names, and had little trouble in demonstrating that the system Rutherford was using was erroneous. Inasmuch as the errors were against himself, the Scotchman was more than pleased to be corrected and his appreciation of his new workman increased accordingly. From that time forth Henry Ericsson measured the brick.

Other jobs followed and by fall he found himself a foreman in charge of the work on a school house on 63rd street, then 'way out on the prairie. All this happened in one season, which was a pretty rapid program for a youngster of 19, and a foreigner at that.

It was while working on a building for the Erie Railroad at Clark and 14th streets that Mr. Ericsson encountered Andrew Lanquist, and in 1883 the two formed a partnership that lasted for 15 years. It was during the term of this partnership that Chicago's first skyscrapers were put up, and the firm constructed two of them in 1891, the 16-story Manhattan building and another 13-story structure. Many factory buildings were erected including the gigantic North Pier Terminal Warehouse.

In 1898 the partnership was dissolved and Mr. Ericsson decided that it was time to retire to the country. The retirement lasted for a period of just three years, at the end of which he came back and established the contracting firm of Henry Ericsson Co., which, to borrow a phrase from a well-known public character who has no further use for it, is "still going strong."

Many of Chicago's most prominent business buildings were put up by Henry Ericsson Co., including the Harvester Building on Michigan Ave., the 20th Century Building on State St., the City Hall Building and the Conway Building on Washington St.

Of course the job done by Henry Ericsson Co. that has been talked about most in the last year or so, is the Camp Grant job, which was begun early in 1918 and which was still in progress when the armistice put a stop to it. It was a clear case of the job seeking the man, for the government application blanks lay around the Ericsson

offices for a month or more before someone filled them out, more as a matter of form than anything else. Then when Mr. Ericsson was passing through Washington on his way to visit one of his sons in the officers' training camp at Camp Lee, he was told by a friend that a big job was coming his way. When he returned to Chicago he found the Camp Grant work awaiting him.

It was midwinter and there were 5 ft. of frost in the ground but work was begun at once and rushed along. The base hospital and warehouses constituted the work to be done under the first contract, the amount involved being about $1,000,000. When that work was done an additional $7,420,000 contract for the enlargement of the camp was awarded to Henry Ericsson Co. It included a host of frame buildings, 15 miles of roads, 30 miles of sewer and water pipe, and it was fast approaching completion when the war ended.

No account, however brief, of Mr. Ericsson's career could omit reference to the 4 years he spent as Building Commissioner under the younger Carter Harrison. The story of all that happened during his incumbency of the office is too long to tell here, but as usual he did a good job.

"What is the name of your new magazine?" asked Mr. Ericsson at the end of our talk.

"Successful Methods," was the reply.

"Well you might say that the only successful method I know is to get out and scratch like Sam Hill."

In accord with Mr. Ericsson's suggestion we'll say so, and stop right there.

PUMP SIZES FOR CONCRETE ROAD WORK

How to Determine the Proper Size of Pump for Use Under Various Conditions

Pumping facilities on concrete road construction are frequently inadequate. Select a pump to fit your several conditions—excess pump capacity is highly desirable.

Q. What factors control the size of the pump?

A. The amount of water required, the vertical distance the water is to be lifted, the horizontal distance the water is to be pumped, the size of the pipe, and to some extent, the bends and valves.

Q. What size pipe should be used?

A. Use not less than 2-in. pipe. Discard all defective lengths and rethread all poor ends.

Q. How do you find the vertical lift?

A. By determining the difference in elevation between the pump and the highest point in the pipe line.

Q. How do you find the horizontal distance?

A. Measure it.

Q. What effect do the size of pipe and valves and bend have on the size of the pump?

A. The friction between the water and the pipe uses up much of the power of the pump, and to a much smaller extent the friction due to valves and bends dissipates the power of the pump. The smaller the pipe the greater the friction.

Q. How far may the pump be above the water surface?

A. Not to exceed 20 ft. and a foot valve and strainer should be on the end of the surface pipe.

Q. How should valves and extra pump joints be spaced?

A. Space valves and extra pump joints about 1000 ft. apart, 2 in. and 1 in. tees from 200 to 300 ft. apart, and unions about 500 ft. apart.

Q. How is water hammer prevented?

A. Use an air chamber.

Q. How much water is required on concrete road work?

A. From 20 to 60 gal. a minute.

Q. How do you find the loss due to friction in the pipe, valves, bends, etc.?

A. These losses are computed in terms called head. The following table gives the losses under various conditions:

TABLE 1. LOSS OF HEAD (IN FEET) IN 2-IN. PIPE IN PUMPING WATER VARIOUS DISTANCES

Water required per min.	1 mile	2 miles	3 miles	4 miles
20 gallons	51 ft.	102 ft.	153 ft.	204 ft.
30 gallons	110	220	330	440
40 gallons	194	388	582	776
50 gallons	296	592	888	1,184
60 gallons	468	936	1,404	1,872

Q. How do you find the horsepower required to raise water to various heights?

A. The theoretical horsepower required (a horsepower is that power required to raise 33,000 lbs. 1 ft. in 1 min.) is given in the following table for various heights:

TABLE II. THEORETICAL HORSEPOWER REQUIRED TO DELIVER VARIOUS QUANTITIES OF WATER LIFTED DIFFERENT HEIGHTS

Water delivered per minute	Height to be raised (in feet) 100	200	300	400	500	600
20 gallons	0.50 hp.	1.00 hp.	1.50 hp.	2.00 hp.	2.50 hp.	3.00 hp.
30 gallons	.75	1.50	2.25	3.00	3.75	4.50
40 gallons	1.00	2.00	3.00	4.00	5.00	6.00
50 gallons	1.25	2.50	3.75	5.00	6.25	7.50
60 gallons	1.50	3.00	4.50	6.00	7.50	9.00

Q. What is the actual horsepower required?

A. Due to various losses in the mechanical operation of the pump, etc., it is necessary to use a much higher power engine than theoretically required. Multiply the theoretical horsepower by 4 for deliveries of 30 gal. per minute or less and by 3 for deliveries of from 30 to 125 gallons per minute.

Q. I need 40 gal. a minute pumped 2 miles over a hill 100 ft. above the pump. How large a pump shall I use?

A. Here is the solution:

From Table I:

Loss in head in pipe line	388 ft.
Vertical height up hill	100 ft.
Estimated loss of head in valves, elbows, etc.	20 ft.
Total head	508 ft.

From Table II:

Theoretical hp. required	5 horsepower
Actual hp. required for engine and pump, three times theoretical hp	15 horsepower

Q. Who says this is a good way to figure the size of pump required?

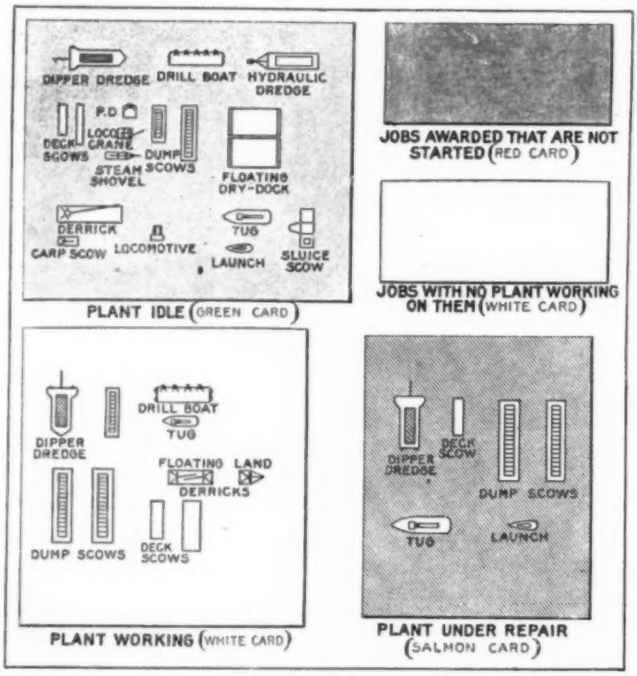
A. Clyde E. Learned, highway engineer, U. S. Bureau of Public Roads, Washington, D. C. in *Public Roads* for June.

BOOKKEEPING WITH MODELS

Visual Method Makes it Easy to Keep Track of Equipment

MODELS are used by the Great Lakes Dredge & Dock Co. to keep track of the location of various pieces of equipment. In the main office in Chicago are display cases 7 by 14 ft., placed on tables covered with ¼-in. plate glass tops. The cases are divided into sections, and each section is labeled according to the job it represents. In the cases are placed pieces of cardboard of various colors; white to indicate plant that is working; green to indicate plant that is idle; and salmon to indicate plant that is under repair. A red card indicates work awarded but not yet started.

Models of each piece of heavy equipment, numbering about 600, are made to a scale of 25 ft. to the inch. These models are placed on the various sheets of cardboard in accordance with existing conditions and are given numbers which help to identify them.



ALL PRESENT OR ACCOUNTED FOR

The models representing steel equipment are painted gray. Those representing wood are varnished. In addition, each one of these models shows the main features of the machine it represents.

This system of keeping track of equipment has been successfully used for several years. While it applies to movable plant only and does not include smaller equipment it enables executives to visualize working progress, and has considerable value for instruction use.

The models are shifted every morning according to the daily reports of the superintendents of the various construction projects scattered over the country.

This method of keeping track of equipment can be applied to other types of work. Highway drainage and building contractors engaged on several jobs at once should be interested.

TRAFFIC DETOUR NECESSARY

Construction Progress Trebled in Massachusetts

A REPORT of the Massachusetts Highway Commission states that on a resurfacing job it was provided that the contractor should resurface only half the width of the road at a time, keeping flag men at each end and letting the traffic through in single file. Early in the spring when there was but little traffic, this was possible, although it slowed up the work materially.

When the heavy summer traffic began, however, the road became so congested and so many automobiles were always waiting at each end, that there was almost a continuous procession. They kept the sub-base constantly rutted and rough, and almost prevented the teams from getting there that had to haul the material on to the road so that it could be built. It also caused long delays and many complaints, not only from the contractor because he couldn't do his work, but from the motorists themselves.

It was found that little work could be done under these conditions and it was decided to detour the traffic for a few weeks. As a result the rate of progress on the work trebled.

STRAW COAT FOR ROAD

In the construction of concrete roads at Camp Grant, Illinois, during the winter straw and other refuse from the stables were successfully used to protect the concrete. The protecting material was all hauled to the roads in dump wagons and placed in a layer 4 to 5 in. thick. This proved a most effective means of protection during extremely cold weather and was easy to remove when it was no longer needed.

COVERING THE ROAD

HAULING FROM STEAM SHOVELS

Number of Wagons Required for Different Lengths of Haul

INFORMATION as to the number of wagons required to take care of the output of a steam shovel for different lengths of haul is sadly lacking.

The following table gives data from which an approximate estimate may be made:

YARDAGE FOR VARIOUS HAULS

Haul in ft.	Round Trips	Cu. yd. per day per team with ½-yd. wagons
500	105	157
1,000	53	79
2,000	26	40
3,000	17	26
5,000	10	15
10,000	4	6

NUMBER OF TEAMS FOR VARIOUS OUTPUTS

Daily output in cu. yds.	Haul 1,000 ft.	Haul 3,000 ft.	Haul 10,000 ft.
250	3	10	41
300	4	12	50
500	8	20	84

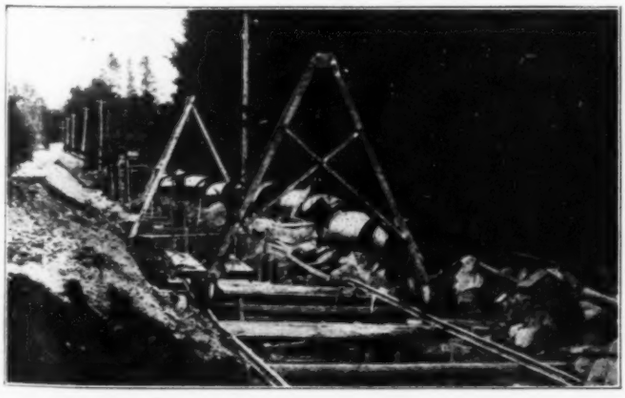
On a road job in Minnesota 5 wagons are serving a ¾-yd. steam shovel on a 300-ft. haul and are kept busy.

At Hamilton, Ohio, a steam shovel with a ¾-yd. bucket, loading gravel on a 3 to 10 ft. face, loaded 480 2-cu. yd. wagons in 9 hrs., and 60 teams were estimated as necessary to keep the shovel busy on a 1-mile haul. The same shovel handled clay out of a 6 to 12 ft. face and should be able to load 360 2-yd. wagons in 9 hrs. This would require 45 teams to haul the material away on a 1-mile haul, 8 trips to the team.

HEAVY PIPE IS HANDLED BY STEEL FRAME

Handling heavy sewer pipe into a deep trench calls for considerable ingenuity if breakage is to be reduced to a minimum. The apparatus illustrated was used on a sewer job in Quebec, Canada. It followed the trenching machine and was used to lower the pipe into place.

The apparatus consisted of a double A frame made up of steel angle bars meeting at a common point and



FRAME WHICH DID THE TRICK

securely riveted. The frame was mounted on four wheels as shown and was thoroughly cross braced. The hand winch securely mounted on one side of the frame and a double chain block furnished the power for handling the pipe. Light track was laid on either side of the trench over which the apparatus traveled.

This machine also was used successfully in lifting heavy boulders out of the trench.

HEAVY STEAM SHOVEL WORK

Side-Hill Job Handled Efficiently by 1½ Cu. Yd. Shovel and Wagons

A SECTION of road 2.3 miles in length near Wabasha, Minn., furnished an opportunity to demonstrate the utility of the steam shovel for side-hill work. The road was cut from a side-hill which had an average slope of

ROAD BUILT WITH STEAM SHOVEL AND WAGONS

2:1. A 1½ cu. yd. shovel and wagons handled the whole job. The cost of this job and the quantities of material used are as follows:

QUANTITIES AND COST OF 2.3 MILES OF EARTH ROAD BUILT WITH A STEAM SHOVEL

Item	Quantity	Unit Price	Total Cost
Clearing and grubbing	.....	....	$ 285.00
Solid rock, cu. yd	17,185	$1.75	30,073.75
Loose rock, cu. yd	6,305	.85	5,359.25
Earth, cu. yd	19,252	.33	6,353.16
Overhaul, cu. yd	20,371	.015	305.57
Rip rap, cu. yd	135	3.00	405.00
Guard rail, lin, ft	5,592	.40	2,236.80
Placing culverts	.....	....	105.86
Culvert end walls, cu. yd	38.96	18.00	701.28
Temporary surfacing, cu. yd	1,955	.60	1,173.00
Culvert haul, cu. yd	119.3	1.00	119.30
Total			$47,162.97

Clearing and grubbing took place over about half the length of the road. The trees averaged about 6 in. in diameter with about 50 to the acre and some rather heavy undergrowth.

The excavation was in soft, seamy sandstone and earth. The seams were horizontal and gopher holes about 18 in. in diameter were made and loaded with from 4 to 6 cans of black blasting powder. The stone was soft enough so that these holes could be cut out with a bar. The blasting simply loosened the rock so that the shovel could handle it.

The cuts were limestone and sandstone ledge and were handled on a 500-ft. overhaul basis. Side slopes and rock cut were ¼:1. A 23-ft. roadway in rock cuts and a 24-ft. roadway in earth were provided. The earth was sandy loam in some places and clay in others. Clay was used for temporary surfacing.

S. J. Groves & Sons Co., Minneapolis, Minn., were the contractors, and C. M. Mathis the county highway engineer.

SERVICE HINTS

WHEELBARROW HINTS

The variety of the uses for wheelbarrows on the average construction job is so great that the value of the tool is not fully appreciated. Try doing without wheelbarrows for a time and see how quick'y they are missed.

Just watch your mixer gang on a rush job and you will be impressed with two facts: (1) it is the wheelers who regulate the speed of your mixer, and the subsequent amount of finished concrete out of the discharge spout; and (2) the wheelbarrows get the hardest knocks, roughest treatment, and most general neglect of any piece of equipment on the job.

It surely pays to keep the wheelbarrows in proper repair, and to use the best of judgment in the selection of types. Nothing can slow up the job more than shaky, crippled wheelbarrows. Also there are wheelbarrows, especially designed for wheeling concrete, others for dirt, and still others for brick, sand or gravel and any of them may be used for odd jobs such as shown in the illustration. It is economy to get wheelbarrows which are made for the job.

A WHEELBARROW ON THE JOB

MEASURING AGGREGATE

There are various methods by which a contractor may determine pay quantities for material used in road building. Car weights are used to a great extent but care must be used in accepting them since the moisture content of the gravel varies greatly, especially in material used for road surface.

This is also true of fine crushed stone. If payment is by the cu. yd. it is well to know just how much a cu. yd. weighs when wet, damp and dry. This point should be watched carefully where payment for hauling is based on the cu. yd. mile haul and material is delivered in railroad cars.

Material sometimes is paid for by place measurement after the road has been built. This calls for careful inspection on the part of the engineer. Perhaps as fair a way as any for measuring gravel hauled in motor trucks is to estimate the size of the load at some point in transit.

If the measurement is made at the loading point, the contractor has a slight advantage; if it is made at the dumping point, the advantage is slightly against him.

FINISHING WAREHOUSE FLOORS

The floors of the warehouse at the foot of 39th Street and Winchester Avenue, Chicago, which was built for use by the United States Quartermaster Department, were left rough, that is, they were poured to within about ½ in. from the top and when the concrete had hardened the surface was uneven. Later a top finish of 1:1½ cement, sand and mortar was applied dry as possible and the mixture was floated and troweled into a somewhat hard and uniform surface. This floor finish was mixed with a separate mixer operated by electricity and moved from floor to floor. The main mixing plant was kept busy with the upper floors while the lower ones were being surfaced.

The building was erected by E. W. Sproul & Co.; S. Scott Joy was the architect; A. F. Stein the structural engineer; and Maj. S. L. Nelson, construction quartermaster, was in charge of the work.

REHANDLING EARTH BY MACHINE

A successful method of transporting earth with a dragline has come into use. This method involves the piling of material in a long windrow, moving the machine to the other side of the windrow and handling the earth again to its final position. In other words, the dragline can be used not only for excavation but also for transporting earth.

On one job, by two handlings, draglines are now placing material 500 ft. or more from the point of excavation. If the first digging is in water the dragline can be mounted on a scow equipped with spuds.

In excavating for the Drake Hotel in Chicago, Anderson Bros., the contractors, are transporting the earth about 100 ft. with steam shovels and then lifting it out of the pit and loading into wagons.

AN ECONOMICAL TOE WALL

A dry rubble toe wall used to retain the fill on heavy side-hill work in Minnesota is shown in the figure. The wall was built where the ground had an average slope of 2 to 1. No attempt was made to bond the wall with headers, but every stone was placed in such a way that there were few holes in the masonry. The smallest block used was about 8 by 12 by 10 in. in size. The big rocks were placed at the bottom.

The interesting feature of this wall is the batter given the outer face making it a combination of a slope wall and a retaining wall.

The use of combined slope and retaining walls has not been fully developed in this country. The mountain roads of Europe furnish many examples of the economy of such walls. Their chief use is on highway work where danger from vibration is not apt to be great.

COMBINED SLOPE AND RETAINING WALL

A FEW BOILER HINTS

There are two methods of making tight boilers for use on construction work. By one method the plates are bent after the holes are cut, and if the holes do not meet they are reamed out before driving the rivets. Unfortunately, this method of boiler riveting leaves a slight bur between the two plates which does not permit close contact at the joint.

By the other method, when plates are bent and the holes do not meet, no attempt is made to ream the holes but the plate is reheated and rebent. When the hole is not reamed out, the contact between the two plates is good, and when the rivet is driven the joint is perfect. There is a frictional resistance added to the shearing strength of the rivet which makes a stronger boiler. In addition to this the chance of leakage is reduced to a minimum.

PORTABLE CONVEYORS FIGHT FIRE

Burning Coal Pile Successfully Handled With the Aid of Small Machines

A BURNING storage pile containing 16,000 tons of coal located in the yards of the Portland Gas Co., at Portland, Me., was successfully scattered with the aid of two portable conveyors.

Fire boats playing salt water through Siamese nozzles into the fire rendered the permanent installation of machinery useless. The small conveyors were then called into service. The 60-ft. conveyor was mounted on adjustable trucks and the 30-ft. conveyor was hung from a trestle and lowered to the piles. As many as 15 men were shoveling at one time to the 60-ft. belt.

Cooperative Service to the Buyer for Export

¶ The export business of the non-competing manufacturers whose advertising appears in this magazine is handled by the Allied Machinery Company of America which has taken over the business of the Allied Construction Machinery Corporation.

¶ Each of these manufacturers maintains independently throughout the United States an effective sales engineering and repair service. It is impracticable, however, for any of them to give such service abroad. At the same time, overseas users of this kind of American machinery have much more need for help from the manufacturers, due to various conditions.

¶ In the first place, delays in delivery multiply as the distance from the factory increases. This makes it necessary to carry local stocks of new machinery and repairs. In fact, a local stock of repairs is vital.

¶ In the second place, the goods must be properly packed and shipped. For example, slight changes in design or production frequently permit more compact packing so that as much as 15% of the total cost of heavy bulk machinery is saved in ocean freight.

¶ Resident sales engineers who know how to install and operate this class of machinery also are specially necessary to overseas users.

ALLIED MACHINERY COMPANY OF AMERICA

Cable Address: ALMACOA

51 Chambers Street, NEW YORK

The branch offices, affiliated companies and representatives of the Allied Machinery Company are located at the addresses given below. Stocks of machinery and repairs are carried at most of these points. Sales engineers also are available there. This service is being expanded as rapidly as conditions will permit.

ARGENTINA—Venezuela 691, Buenos Aires.
J. A. Cordeal—Cable Address: ALMACOA.

AUSTRALIA—76 Pitt Street, Sydney.
A. N. Herrick—Cable Address: CONALMAC.

BELGIUM—34 and 36 Rue Melsens, Brussels.
Allied Machinery Co. of America—Cables: ALMACOA.

BRAZIL—90-92 Rua Sao Pedro, Rio de Janeiro.
Oscar Taves & Company—Cable Address: ARAMPO.

BRAZIL—Sao Paulo—Byington & Company.
Cable Address: ALTON.

CEYLON—P. O. Box 193, Colombo, L. R. Vinall-Moon.
Cable Address: ALMACOA.

CHILE—Iquique—Allied Machinery Company of America.
Cable Address: ALMACOA.

CHILE—Calle Bandera 261, Santiago.
Allied Machinery Company of America.
Cables: ALMACOA.

CUBA—Havana—Allied Machinery Company of America, Obrapia 23. Cable Address: ALMACOA.

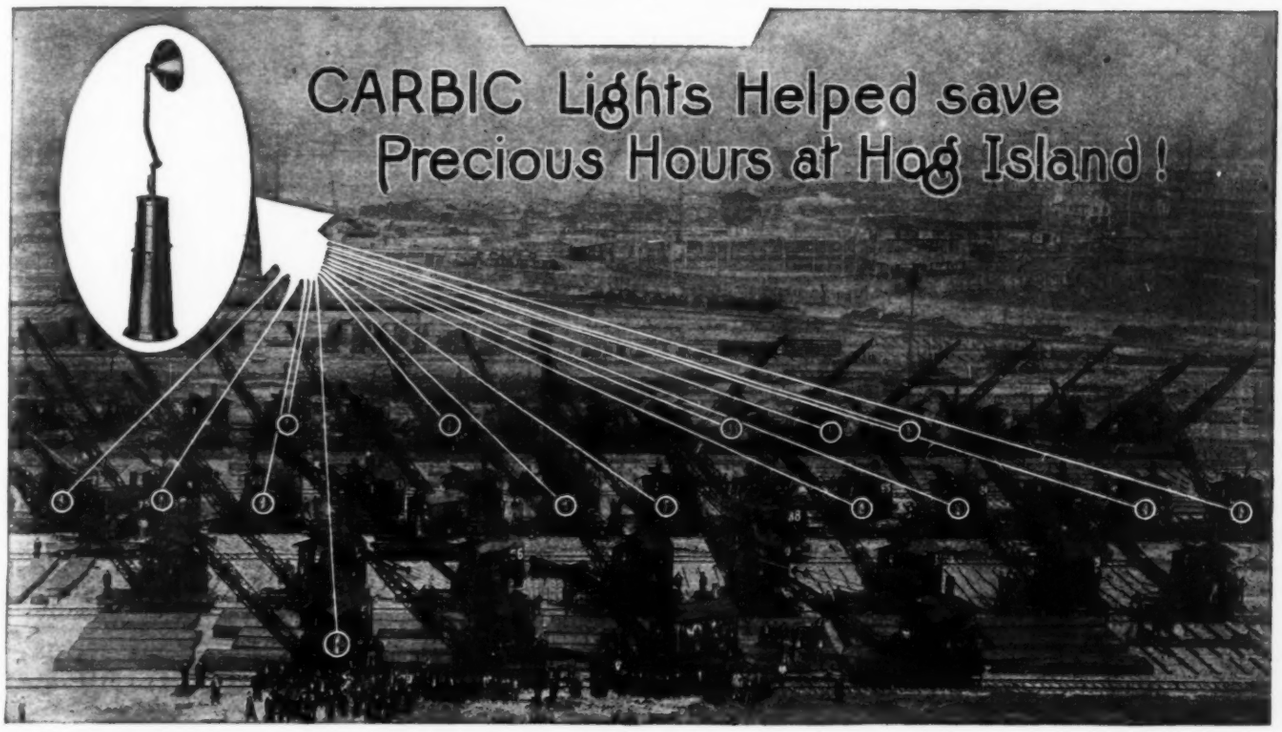
ENGLAND—London—18 Birchin Lane, Lombard Street, B. C. Milner. Cable Address: AMINTERCOR.

FRANCE—Paris—Allied Machinery Company de France, 19 Rue de Rocroy. Cable Address: ALMACOA.

ITALY—Turin—Allied Machinery Company d'Italia, Via XX Settembre 12. Cable Address: ALMACOA.

JAPAN—Tokyo—Horne Company, Ltd., 6-7 Takiyama-cho, Kyobashi-ku. Cable Address: Horne.

SPAIN—Barcelona—Plaza de Cataluna 8.
C. B. Watrous.



DURING the stress of War when Time was the most valuable thing in the world and when the saving of it meant everything to the Cause, CARBIC Lights helped save many precious hours.

At the plant of the American International Shipbuilding Corporation at Hog Island dozens of cranes were used to speed up the work. When the daylight hours were gone Carbic Lights were put to work on these cranes. Their clear, white flare lent the necessary light for maintaining ceaseless and uninterrupted activity.

When darkness came CARBIC Lights "rode in the saddle" hour after hour while in their glare boom after boom swung back and forth helping to clear the way to the Rhine.

Carbics played an important part here when hours and days saved meant everything to Humanity. Now as ever they are solving the problem of speeding up construction work for many a contractor, where Economy, Efficiency, Safety, Service and Portability are Light requirements.

Write for interesting data including complete catalog. A postal will do — mail it today.

Carbic Manufacturing Company

NEW YORK DULUTH CHICAGO

Main Office and Factory

BRANCH OFFICES

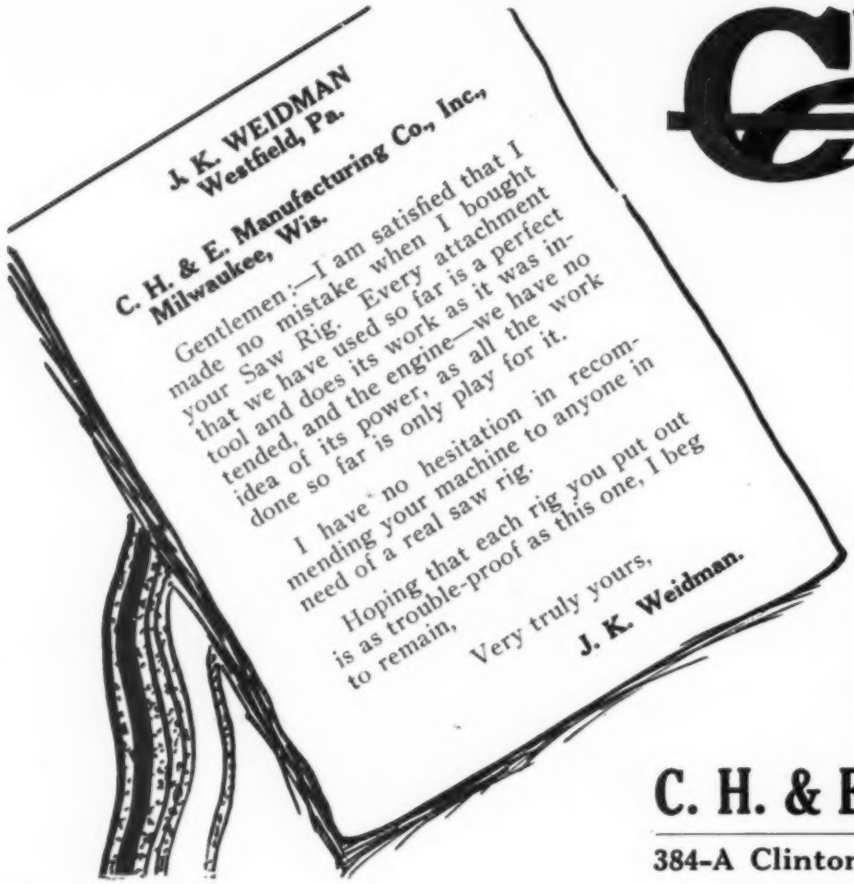
BOSTON, 27 School Street
PHILADELPHIA, 18 South 7th Street

ALLIED

PITTSBURGH, 101-109 Galveston Ave., N. S.
CLEVELAND, 619 Guardian Building

Warehouses and Representatives in Other Principal Cities

CARBIC FOR LIGHTING—WELDING—CUTTING


J. K. WEIDMAN
Westfield, Pa.
C. H. & E. Manufacturing Co., Inc.,
Milwaukee, Wis.
Gentlemen:—I am satisfied that I made no mistake when I bought your Saw Rig. Every attachment that we have used so far is a perfect tool and does its work as it was intended, and the engine—we have no idea of its power, as all the work done so far is only play for it.
I have no hesitation in recommending your machine to anyone in need of a real saw rig.
Hoping that each rig you put out is as trouble-proof as this one, I beg to remain,
Very truly yours,
J. K. Weidman.

C H & E

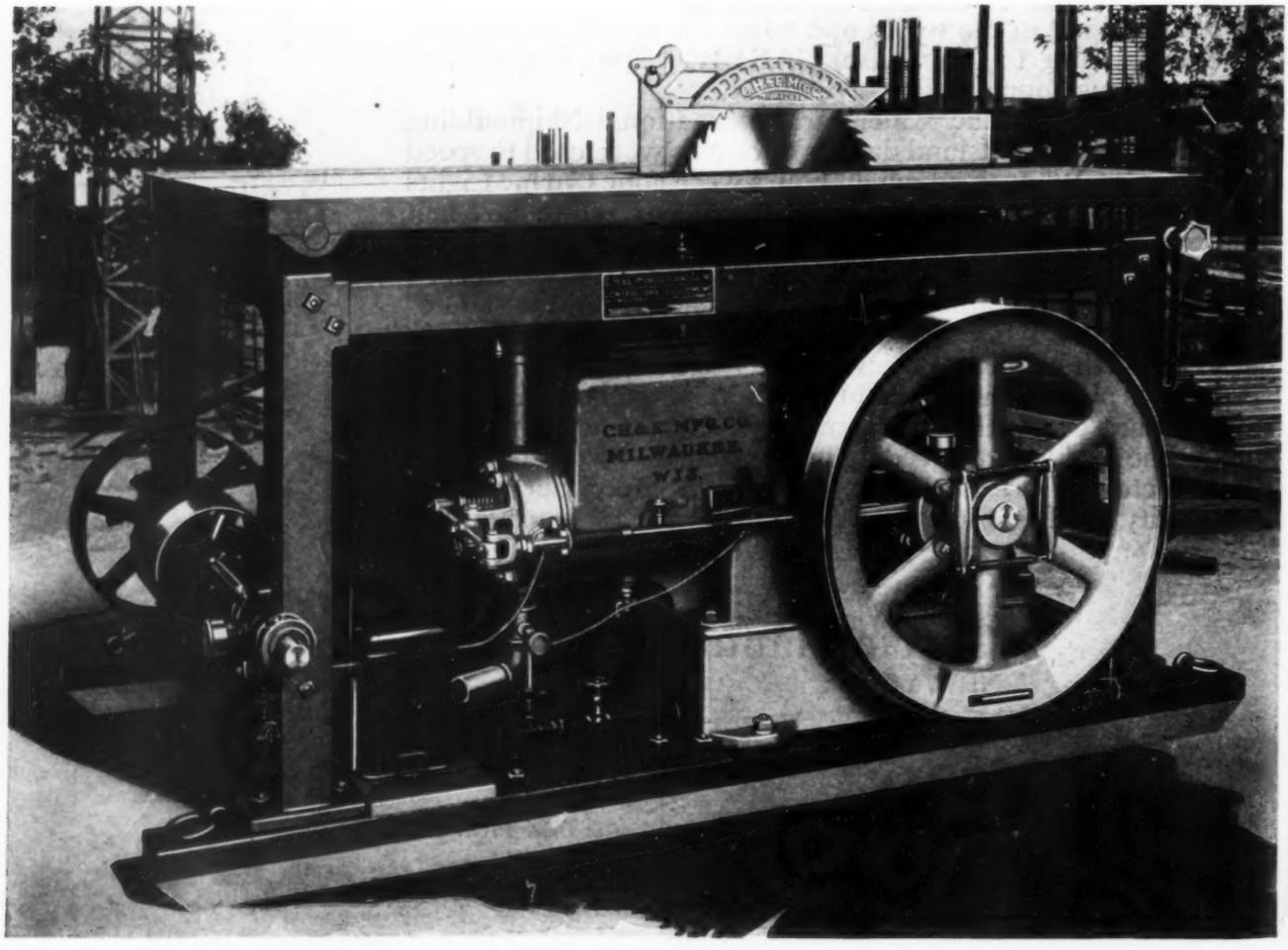
57 VARIOUS SIZES—

- 8 complete sizes Portable Saw Rigs (3 to 8 horsepower), gasoline or kerosene engine or electric motor driven.
- 2 sizes Power Driven Trench Pumps.
- 9 sizes Power Driven Centrifugal Pumps.
- 5 sizes Power Driven Piston Pumps.
- 6 sizes Power Driven Triplex Pumps.
- 1 size Road Oil Pump and Expansion Joints for road builders' pipe lines.
- 9 sizes engine and motor driven Builders' Hoists and Material Elevators.
- 2 sizes Mortar Mixers.
- 8 sizes Gasoline and Kerosene Engines.

C. H. & E. Manufacturing Co.

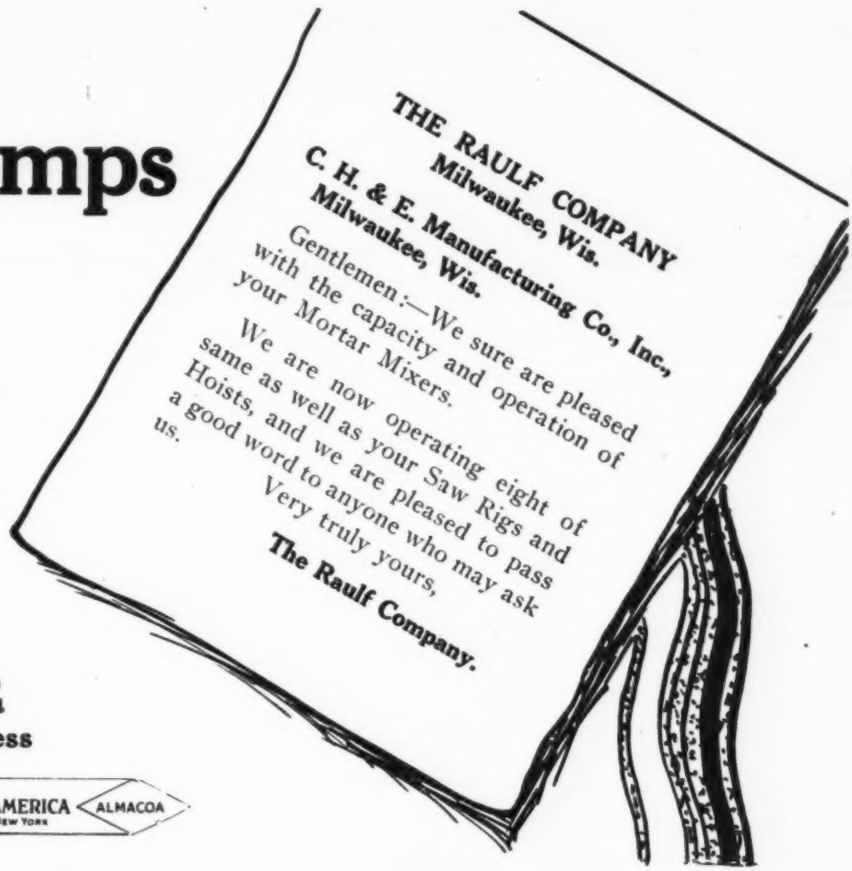
INCORPORATED

384-A Clinton Street Milwaukee, Wis.



Saw Rigs
Power Pumps
Hoists
Elevators
Mixers
Engines

Write for
CATALOG
Just Off the Press


THE RAULF COMPANY
Milwaukee, Wis.
C. H. & E. Manufacturing Co., Inc.,
Milwaukee, Wis.
Gentlemen:—We sure are pleased with the capacity and operation of your Mortar Mixers.
We are now operating eight of same as well as your Saw Rigs and Hoists, and we are pleased to pass a good word to anyone who may ask us.
Very truly yours,
The Raulf Company.

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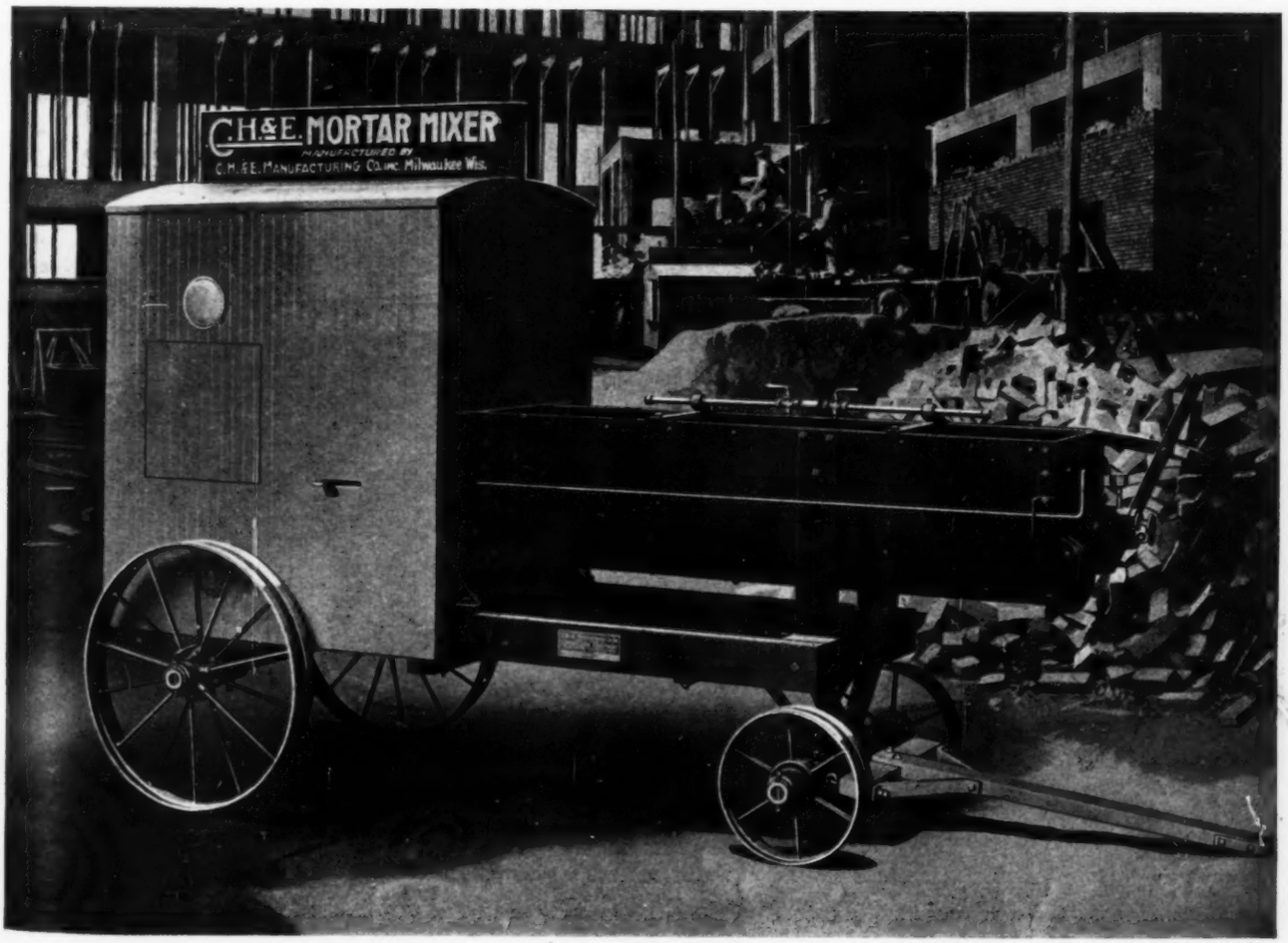


BARBER
COM

Belt Conveying Sh

When it's a material handling job for a short haul you can cut costs.

Contractors—the country over—formerly wasted money on material handling. Many now have adopted the belt conveyor principle for short-haul work.

Industries, too, have been quick to see the wisdom of handling material by belt conveyor. The saving they now make monthly in this class of work has broken the back of this former profit-thief.

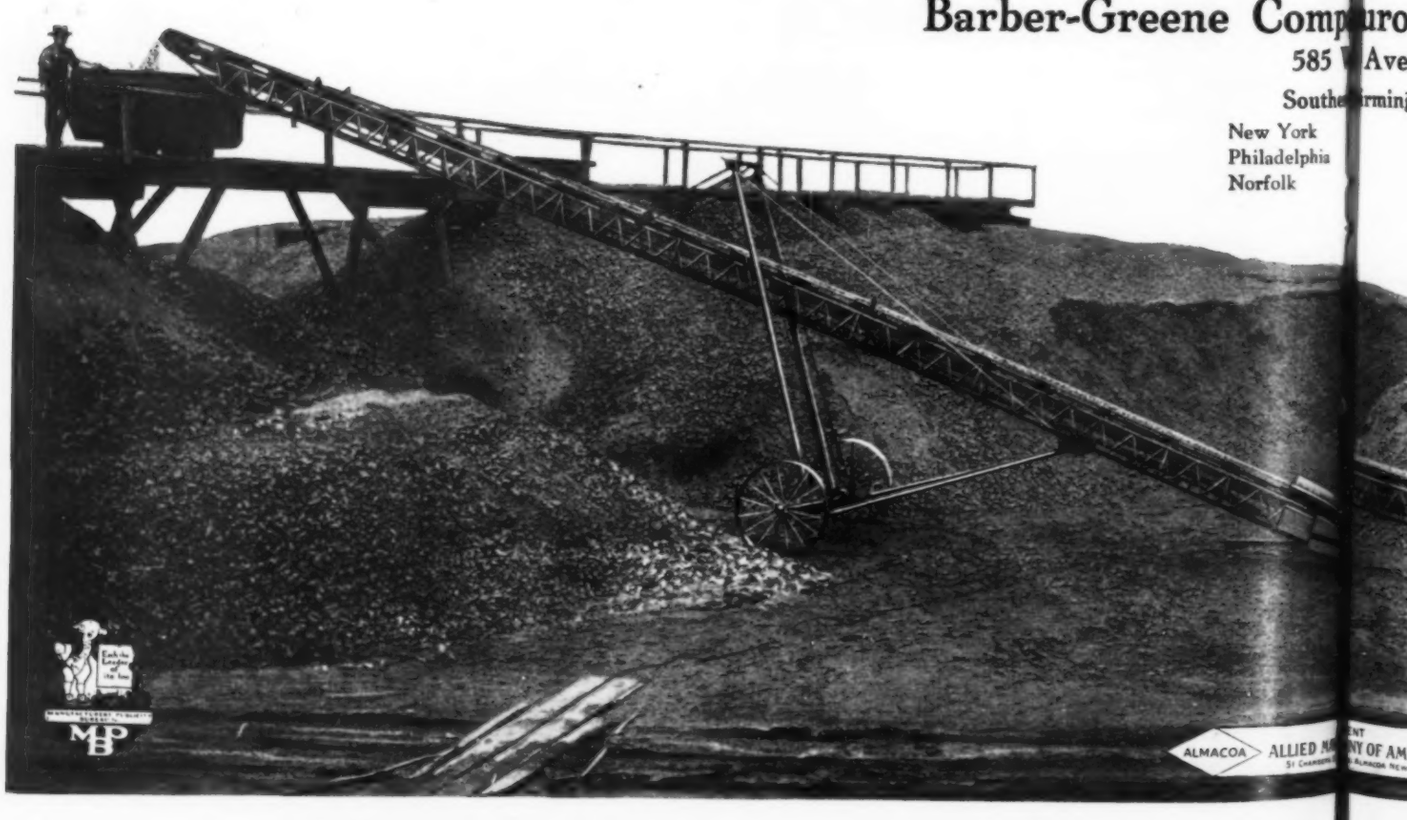
For, by belt conveyor, 50% to 90% cost reduction results—that's why the B-G Portable Belt Conveyor has made so many friends from Coast to Coast.

B-G Portable

Illustration below shows B-G Portable Belt Conveyors Style "A" (30-foot and 60-foot lengths) with the B-G Self-Feeding Bucket Loader. An actual loading and conveying job.

B-G Portable Belt Conveyo... several... regularly equipped with el... can be... drive—adjustable to 12-foot... hs—de... experienced conveying enj...

Barber-Greene Compa... uro...
585 W... Ave...
South... rmin...
New York
Philadelphia
Norfolk



ALMACOA ALLIED M... NT OF AM...

GREENE
MANY

B
G

ng Short-Haul Work

A belt conveyor is as practical as any first-class machine you use. When you see the B-G Portable Belt Conveyor in operation you will say that here's the equipment for you to use on your jobs.

Huge coal piles are carried away at the rate of many dozens of tons each hour; earth, clay, sand, stone, gravel, coke, lime, etc., are all alike to this machine.

For the B-G Conveyors are adaptable to a great range of uses. They stand up under the hard punishment of handling heavy material—and—don't forget—B-G Conveyors are *portable.* Lead them right to the job and they lend themselves to the particular conditions there.

tab lt Conveyors

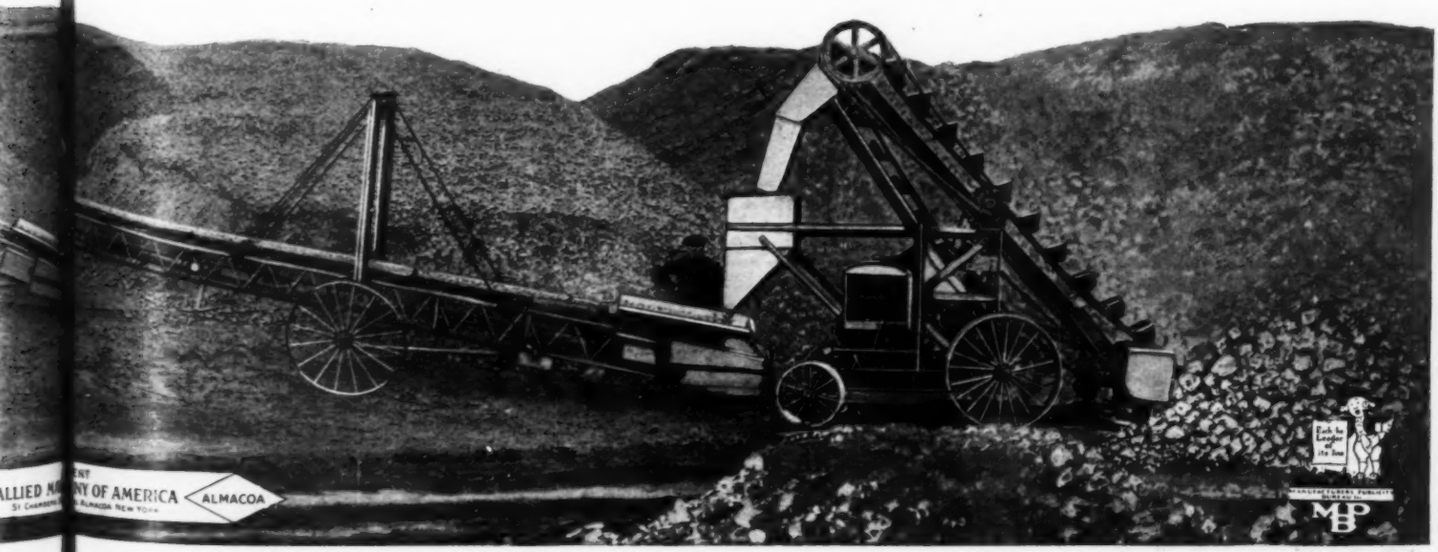
*Convey several styles and capacities—
l with el can be supplied with gas-engine
to 12-foot lts—designed and perfected by
ying enj*

Write to the B-G representative nearest you, and our Service Engineer will work out your conveying and loading plans with you.

omp urora, Illinois, U. S. A.
585 W Avenue
South rmingham

York	Cleveland	Pittsburgh	Milwaukee	Omaha	Los Angeles	New Orleans
elphia	Detroit	Scranton	Minneapolis	Kansas City	San Francisco	Tampa
k	Indianapolis	Chicago	St. Louis	Salt Lake	Portland	Savannah

Canadian Agents—Mussens Limited, Montreal, Toronto, Winnipeg, Vancouver



LAKEWOOD
BUILT TO LAST

Which Method

The OLD *Way Means*

Big wheelbarrow and shovel crews.
Road work must stop in wet weather.
Sand and stone piles on the grade.
Aggregates mixed with dirt of subgrade.
5 to 10 per cent. loss of material.
Delay in starting concrete work until material is stocked on grade.
Working season shortened.
Sand and stone hauled over grade in trucks. Subgrade must be refinished.
Caring for cement sacks, which increases cost.
Difficult operation on narrow roads.
Small amount of road finished in a season.

The Lakewood System is efficient on narrow and wide roads and a contractor can finish three or four times as much road in one season. Have you Bulletin 29?

Lakewood Road Co

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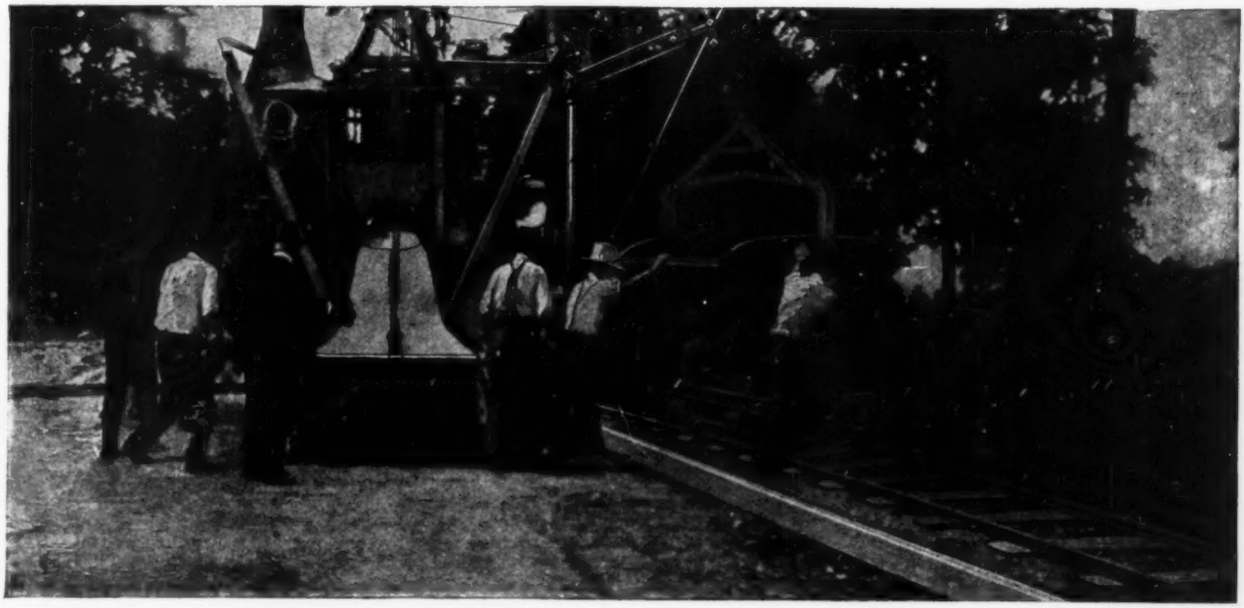
LAKEWOOD BUILT TO LAST



Will *You* Use?

No wheelbarrow or shovel crews.
Continuous operation regardless of weather.
No stock piles on grade.
Batches dumped from cars into charging skip by means of Lakewood Batch Transfer.
Clean aggregates assured.
No waste of material.
Concrete placing begun as soon as grading is started.
Working season practically doubled.
No hauling over subgrade. Once finished subgrade needs no further attention.
No cement sacks at the mixer. Cement bags emptied into road cars at central loading plant.

The LAKEWOOD *Way Means*

THE LAKEWOOD ENGINEERING COMPANY
CLEVELAND, U. S. A.

Offices in New York, Boston, Philadelphia, Washington, Pittsburgh, Detroit, Chicago, Milwaukee. Salt Lake City, Los Angeles, Seattle, Oklahoma City, Kansas City and Houston.

Construction Plant

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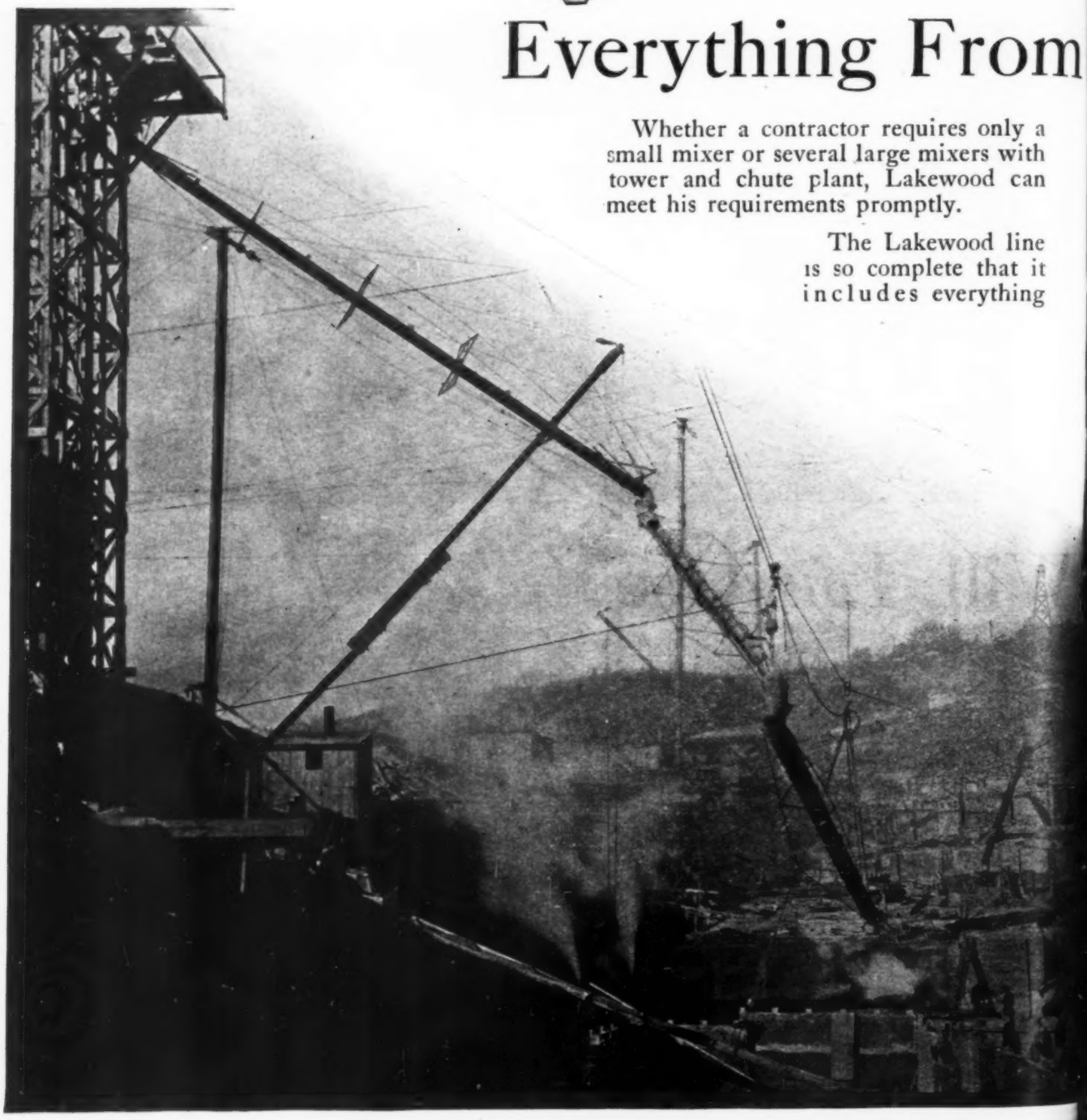
LAKEWOOD
BUILT TO LAST

Everything From

Whether a contractor requires only a small mixer or several large mixers with tower and chute plant, Lakewood can meet his requirements promptly.

The Lakewood line is so complete that it includes everything



Lakewood Cons

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LAKEWOOD BUILT TO LAST

Chuting Plants to Small Mixers

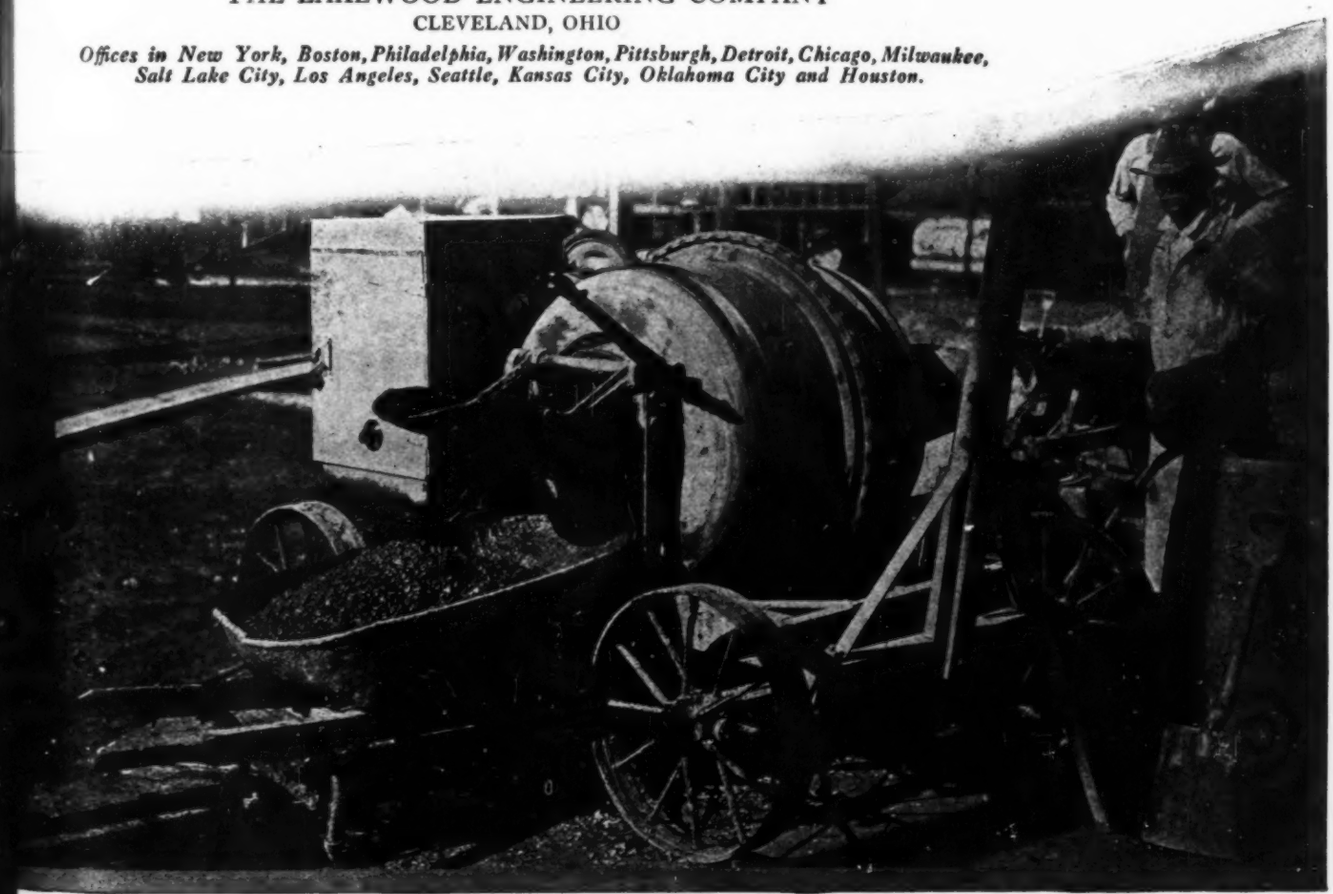
that has to do with the mixing and placing of concrete. It includes mixers (sizes 4, 7, 14, 21, 28 and 56 cu. ft.), chute elevating buckets, towers, tower hoppers, floor hoppers, concrete buggies, radial gate and V-dump cars, portable track, turntables, switches, bin gates, tunnel traps, mortar mixers, clam shell buckets, grout mixers, paving mixers, road finishing machines, etc.

In the selection and arrangement of plant to meet requirements of the job Lakewood Engineers can help you. They recommend plant that will earn maximum profit for the user.

Have you the Lakewood Bulletins?

THE LAKEWOOD ENGINEERING COMPANY
CLEVELAND, OHIO

Offices in New York, Boston, Philadelphia, Washington, Pittsburgh, Detroit, Chicago, Milwaukee, Salt Lake City, Los Angeles, Seattle, Kansas City, Oklahoma City and Houston.



truction Plant

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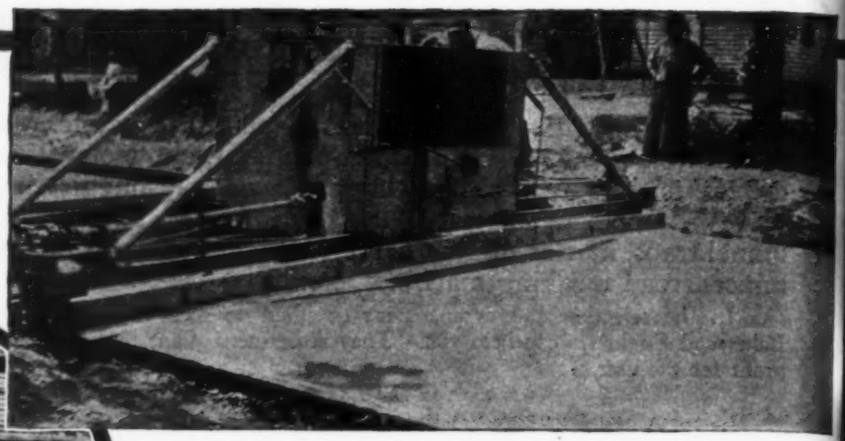
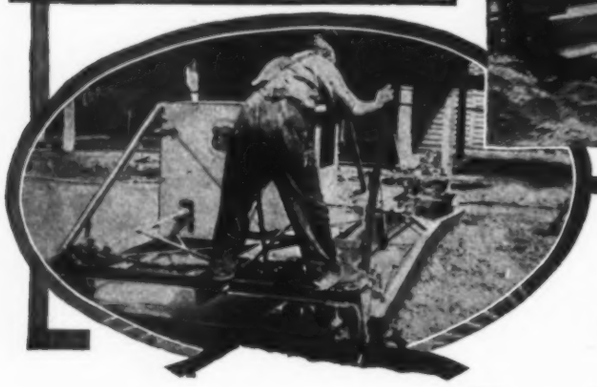
LAKEWOOD BUILT TO LAST

The illustrations show one of the two Lakewood Concrete Road Finishers used on the Belleville-Shiloh Road in St. Clair County, Ill. The first machine was purchased by Keely Bros., Contractors, of East St. Louis. After it had been in use several weeks the County purchased a second one.





Get the Facts About This

Lakewood Concrete Road Finisher

It automatically spreads, tamps and finishes the concrete.

A member called the strike-off spreads the concrete to the necessary height and crown. The tamping member subjects the concrete to continuous agitation, removes the voids and brings the surface to the exact height and crown. A belt, at the rear, finishes the surface.

One man, with the Lakewood Finisher and two helpers, can do the work usually done by 8 or 9 men when working dry concrete.

A coarser, drier mixture can be used and a stronger, denser concrete results.

Send for Bulletin 28-B—It Gives Complete Information

THE LAKEWOOD ENGINEERING CO.
CLEVELAND, U. S. A.

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Lakewood Road C

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